United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Montana Agricultural
Experiment Station

Soil Survey of Madison County Area, Montana

How To Use This Soil Survey

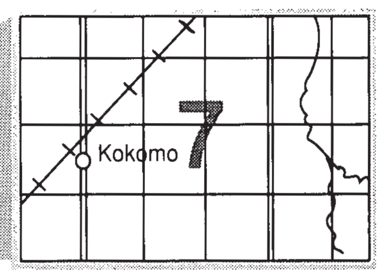
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

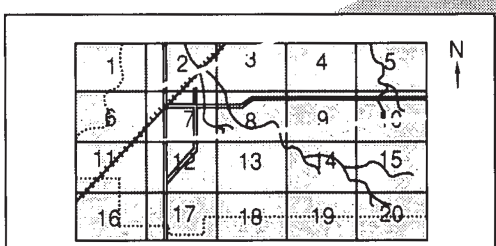
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



MAP SHEET

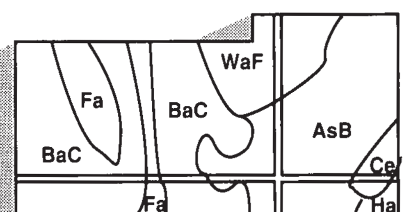
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.

MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agancies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1980. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service; United States Department of Agriculture, Forest Service; United States Department of the Interior, Bureau of Land Management; and Montana Agricultural Experiment Station. It is part of the technical assistance furnished to the Ruby Valley, Madison, Jefferson Valley, and Beaverhead Conservation Districts.

Financial assistance was provided by the Old West Regional Commission in cooperation with the Montana Department of State Lands and the Montana Association of Conservation Districts; the Board of County Commissioners, Madison County; and the Burlington Northern Railroad, Inc.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

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Issued September 1989

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Foreword

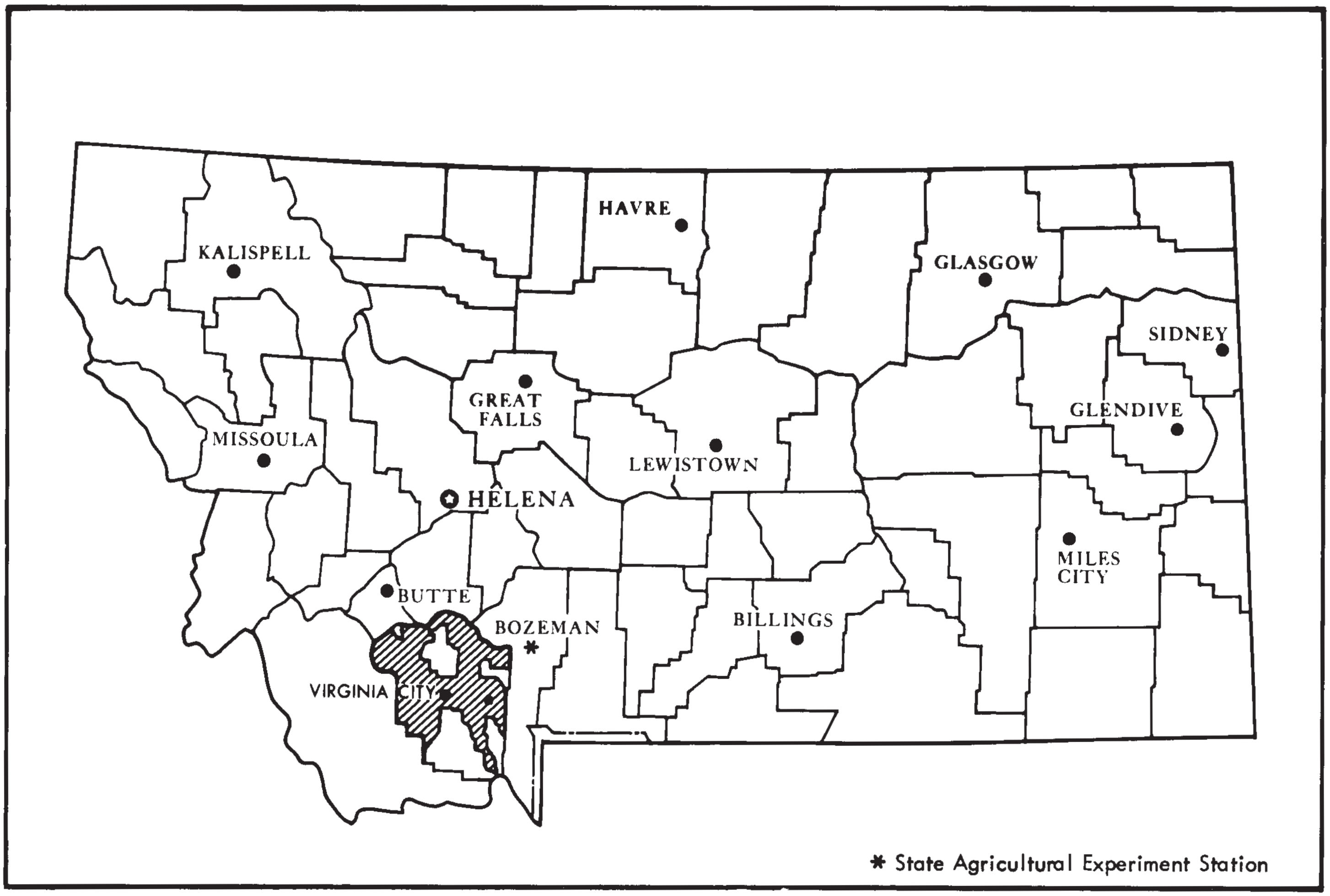
This soil survey contains information that can be used in land-planning programs in Madison County Area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Glen H. Loomis
State Conservationist
Soil Conservation Service



Location of Madison County Area in Montana.

Soil Survey of
Madison County Area, Montana

By Robert R. Boast and Ronald G. Shelito, Soil Conservation Service

Fieldwork by Robert R. Boast, Ronald G. Shelito, June G. Haigh, Daniel L. McLean, and Dennis R. Smetana, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
in cooperation with
United States Department of Agriculture, Forest Service; United States Department of the Interior, Bureau of Land Management; and Montana Agricultural Experiment Station

MADISON COUNTY AREA is in the southwestern part of Montana. It has an area of 1,556,880 acres, or about 2,433 square miles. The survey area is in the Rocky Mountains and in intermontane valleys on the eastern side of the continental divide. It includes all of Madison County except for those parts in the Beaverhead, Gallatin, and Deerlodge National Forests. Virginia City is the county seat.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

General Nature of the Survey Area

In this section the history and development; transportation facilities; physiography, drainage, and geology; mineral resources and water supplies; and climate of the survey area are discussed.

History and Development

The survey area appears not to have been the permanent home of any Indian tribe in historic times. The Madison and Ruby Valleys were used by Indian tribes in their travels to and from the plains to hunt buffalo. Some of the earliest treaties designated southwestern Montana as a common hunting ground *(6)*.The first record of white man visiting the area is that of Lewis and Clark. They arrived at the present site of Twin Bridges on August 6, 1805. For a short period beginning in 1810, the Missouri Fur Company sent its men into the area from its trading post at Three Forks. The American Fur Company began operating within the area in the early 1830's.

Gold was discovered in what is now called Alder Gulch on May 16, 1863. Within a year, about 10,000 miners had begun working these deposits.

The county was first established in the Territory of Idaho on January 16, 1864. It became part of Montana when the Montana Territory was admitted into the Union on May 26, 1864.

On February 7, 1865, the capital of the Montana Territory was moved from Bannack to Virginia City. For a decade Virginia City was the financial, governmental, and population center of the Territory. Because of Virginia City's declining population, the capital was moved to Helena in January 1875. Virginia City remains the county seat, and for many years it was the only incorporated town in the county. In 1980 the county had a population of 5,448 *(14)*. Madison County today, as in the early days of its existence, lies outside the main east-west routes of travel across the state.

According to the Census of Agriculture *(13)*, 433 farms were in Madison County in 1978. The average farm size was 2,515 acres, down from 3,103 acres in

1974. There was 140,181 acres of irrigated cropland. Crops harvested in 1978 included 53,432 acres of alfalfa hay, 15,573 acres of wild hay, 13,564 acres of barley, 6,510 acres of wheat, and 1,511 acres of oats. The main source of agricultural income within the county is livestock. In 1979 there were 54,000 head of beef cattle, 13,500 sheep, and 200 dairy cattle *(8)*. In 1978 there were 2,900 hogs and pigs in the county.

Transportation Facilities

The main line of the Burlington Northern Railway borders the county on the north, paralleling the Jefferson River and extending from Whitehall to Sappington Junction. At Whitehall a branch line of the Burlington Northern serves the western half of the county's agricultural area, passing through the towns of Waterloo, Silver Star, Twin Bridges, Sheridan, Laurin, and Alder. A second branch that serves the eastern part of the county runs from Sappington Junction to Harrison.

Several State highways and many improved county roads traverse Madison County. From U.S. Highway 10, which borders the county on the north, Montana Highway 41 starts at Cactus Junction. It enters the county a few miles north of Waterloo, goes through Twin Bridges, and ends at Dillon in Beaverhead County. U.S. Highway 287 enters the northeastern part of Madison County and follows a southerly route through the county. It passes through the towns of Harrison, Norris, and Ennis and continues on to Yellowstone National Park. Montana Highway 287 starts at Ennis and passes through Virginia City, Alder, Laurin, and Sheridan, and it connects with Montana Highway 41 at Twin Bridges. Interstate Highway 15 passes through the extreme western part of the county near Melrose. Montana Highway 87 enters the county from Idaho in the southeastern corner of the county and joins U.S. Highway 287 on the Missouri Flats. County Road 289 begins at Norris and extends west to the Gallatin County line.

Two local airports, at Twin Bridges and Ennis, are maintained within the county. The nearest commercial airline facilities are at Butte in Silver Bow County and at Belgrade in Gallatin County, 50 to 60 miles distant.

Physiography, Drainage, and Geology

By Clifford A. Balster, geologist.

The survey area is in the Northern Rocky Mountain physiographic province. Short mountain ranges and associated intermontane basins dominate the topography. The mountain ranges are largely the result of complex faulting and uplift.

Basin morphology and topography are the result of a combination of structural subsidence, filling by deposition, and erosion of the deposited sediment. Much of the uplift that contributed to the development of the topography of the area has been attributed to activity during Late Cretaceous and Tertiary time, but recent opinions favor continuation of deformation into Pleistocene and even Holocene time.

Development of the basins between the mountain ranges, often referred to as valleys, seems to have followed a common format. The subsiding basins were progressively filled with sediment carried into them by streams draining the adjacent mountain ranges. The master streams, occupying the basin bottoms, were greatly overloaded by the supply and could not carry material away as fast as it was provided. Abundant volcaniclastic material, such as ash and breccia, were often added to the already excessive supply of sediment. The resulting basin-fill material is a complex mixture of debris from erosion and volcaniclastic material.

Dumping of material into the basins continued until they became broad and relatively flat bottomed. Cessation of extensive volcanic activity relieved some of the excessive overloading of streams, and the master streams that occupied the basinal bottoms began to stabilize and gradually cut laterally, forming broad valleys. Later uplift resulted in downcutting by the streams, forming several levels of terraces. Throughout this time, erosion of the mountainous terrain continued and the streams draining the mountains carried sediment into the basins.

During the formation of the highest level of terraces, extensive coalescing alluvial fans began to form at the mouths of the canyons along the mountain front. Fan deposition continues today, and these coalesced fan deposits are characteristic of the materials of the mountain fronts along the basin borders. With each episode of uplift and subsequent downcutting, a new level was established for the master stream and lateral erosion began the development of a new terrace level. Prominent steep scarps, with relief varying from a few feet to as much as about 100 feet, mark the boundaries between terrace levels. The broad basinal valleys between mountain ranges typically have a topography of stepped terrace sequences with an apron of coalescing alluvial fans along mountain fronts.

Two major stream systems drain the survey area.

The Madison River system drains the eastern part of the county, and the Jefferson River and its tributaries drain the western part.

The Madison River flows northward to Ennis Lake in a broad basinal valley with numerous terrace levels and an extensive apron of coalesced fans bordering the mountain ranges. From the dam at Ennis Lake to a point in the southern half of Township 3 South, Range 1 East, Beartrap Canyon is the steep-sided, narrow valley of the Madison River. At the mouth of Beartrap Canyon, the river again exits onto a broad alluvial plain that is not characterized by the several levels of terraces that are so prominent in the upper valley; neither are the extensive fans present.

A small area along the eastern margin of the county is drained by tributaries of the Gallatin River. Tributaries of Spanish Creek, in the northeastern part of the county, drain the largest area. Numerous small streams drain the area south of the Spanish Creek drainageway and north of the Taylor Fork drainageway. From the Taylor Fork southward, all drainage is into the Madison River system.

Numerous tributaries head in the Madison Range and flow into the Madison River from the east. Cherry Creek is the only sizable stream to empty into the Madison River north of Beartrap Canyon. South of Beartrap Canyon, Jackass, Cedar, Bear, Indian, Corral, Wolf, Moose, Squaw, and Papoose Creeks are all relatively small streams that rise in the Madison Range and empty into the Madison River.

A prominent valley in the southeastern corner of the survey area, containing Wade, Cliff, Hidden, and Elk Lakes, probably represents an ancient and abandoned valley of a major tributary of the Madison River. Although there are no visible streams connecting the lakes, at least part of the system now appears to drain southward into the Red Rock Lake basin via Elk Creek. Tributary streams account for a considerable volume of input into the system, which must be balanced by outflow. Hidden, Cliff, and Wade Lakes may drain into the West Fork of the Madison River through underground gravel beds. Elk Lake drains southward into the Red Rock Lake basin via Elk Creek. Abandonment of this major valley most likely was caused by active uplift of the area during recent times.

The West Fork of the Madison River and its tributary, Elk River, is a major drainageway that empties into the Madison River from the west in the southern part of the county. Northward from the West Fork of the Madison River, Gazelle, Standard, Horse, Wall, and Hyde creeks and the Ruby River account for most of the drainage from the Gravelly Range. Numerous minor intermittent tributaries furnish a small amount of water to the Madison River system, particularly at the northern end of the range.

The Big Hole, Beaverhead, and Ruby Rivers join near Twin Bridges to form the Jefferson River. These streams and their tributaries drain the western part of the survey area. In most respects the valleys of these streams resemble the Madison valley, but terrace levels are not so numerous. As in the Madison valley, coalescing fans are a prominent feature at the border of the mountain ranges.

The Ruby River and its tributaries drain the west slope of the Gravelly and Greenhorn Ranges, the east slope of the Ruby Range, the west slope of the Tobacco Root Mountains, and both the east and west slopes of the Snowcrest Range. Small tributaries of the Beaverhead River drain the west slope of the Ruby Range. Tributaries of the Big Hole River drain the area around McCartney Mountain and the southernmost part either of the mountain ranges. It is drained by Alder Creek. Important streams draining the Greenhorn Range are Idaho, Greenhorn, and Warm Spring Creeks. Cottonwood Creek, the East Fork of the Ruby River, and Coal Creek are the major streams that flow from the Gravelly Range into the upper reaches of the Ruby River. Cottonwood, Sage, and Sweetwater Creeks flow from the Ruby Range into the Ruby River. Ledford Creek and the West Fork of the Ruby River are the principal tributaries of the Ruby River coming from the Snowcrest Range.

Most of the valley of the Ruby River, above the Ruby Reservoir, is broad and has moderate relief. In Section 18, Township 9 South, Range 3 West, the Ruby River flows through a short, narrow canyon cut through the Phosporia Formation, which is of Permian age. The alluvial valley bottom above this narrow canyon is conspicuously narrower than that of the lower reaches, and the surrounding country is more hilly and has greater and sharper relief. Ruby dam is at the upper end of a narrow canyon cut into Precambrian crystalline rock. This canyon is also short and steep sided. Below the canyon, the valley again broadens and its flanks are marked by coalesced alluvial fans along the margins of the mountains on both sides. Near the confluence of the Ruby River with the Beaverhead River, the total width of the basinal valley is nearly 16 miles. Of this total width, flood plains and low terraces make up about 6.5 miles of the width and fans occupy the rest.

Numerous small tributaries of the Beaverhead River drain the northwest side of the Ruby Range. McHessor, Trout, Spring, and Stones Creeks are the most important streams.

The north end of the Tobacco Root Mountains is drained by two important streams that empty into the Jefferson River. South Boulder River is the larger of these. Willow Creek, east of the South Boulder, is the smaller.

Geology of the survey area is very complex and, by itself, would justify a voluminous publication. Consolidated rocks range in age from some of the oldest Precambrian crystalline rocks to sedimentary beds of Oligocene age. Unconsolidated materials include alluvium from streams, fans, and terraces as well as glacial outwash and morainal material.

Major areas of outcrops of Precambrian crystalline rock in the survey area are near Beartrap Canyon and the town of Norris, around the flanks of the Tobacco Root Mountains, in the Virginia City area, between Ennis and Alder, and in the vicinity of the ghost town of Rochester. Smaller areas crop out in the Ruby Range, along the eastern flank of the Gravelly Range, and in the Madison Range.

Paleozoic sedimentary rocks range in age from that of the Cambrian Flathead Quartzite to the Permian Phosporia Formation. Outcrop patterns are complex and thus cannot be readily described. In general, it may be stated that outcrops of Paleozoic rocks are associated mostly with the flanks of the mountain ranges and are severely folded and faulted. The Ruby, Gravelly, Snowcrest, Greenhorn, and Madison Ranges all exhibit this pattern of Paleozoic outcrops. Dips commonly are steep, and outcrops commonly are discontinuous because faulting has displaced them. Where continuous outcrops can be observed crossing the countryside, they commonly are sinuous and obviously are distorted.

Lithologies common in Paleozoic rocks include limestone, sandstone or quartzite, dolomite, and shale. Rocks of the Cambrian System include quartzite, limestone, and shale. Dolomite is the most common lithology in the Devonian rocks. The Madison Limestone is of Mississippian age. Pennsylvanian rocks are predominantly quartzite. Permian lithologies run the gamut; sandstone, limestone, shale, dolomite, and chert in various proportions make up this section. Some of the beds are highly phosphatic and have been mined for their phosphate content.

Cenozoic rocks (Triassic, Jurassic, and Cretaceous) are mostly shale and sandstone with a minor amount of limestone. Triassic red beds are probably the most conspicuous of this sequence by virtue of their color. Jurassic rocks are a minor constituent in the survey area and are mostly gray shale and limestone. Rocks that are of Cretaceous age are of both sedimentary and igneous origin. The oldest sedimentary rocks of the Cretaceous belong to the Kootenai Formation, a sequence of sandstone and shale. The balance of the Cretaceous sedimentary section is composed predominantly of dark gray shale with lesser amounts of sandstone and a minor amount of coal. Most Cenozoic rocks are associated with the mountainous areas of the county, but there is a relatively extensive area of outcrop on the west flank of the Gravelly Range and minor outcrops in the Madison Range. A small area of undifferentiated Jurassic and Cretaceous rocks flanks McCartney Mountain.

Igneous activity that began in Cretaceous time and ended in the Tertiary produced both intrusive and extrusive rocks. The intrusive rocks are more coarsely crystalline and belong to the quartz monzonite, andesite, and granodiorite families. Fine-textured extrusive rocks include varieties of basalt, rhyolite, and andesite. Flows, tuffs, and breccias are all common. The Madison Range, Tobacco Root Mountains, and McCartney Mountain each have notable areas of intrusive lithologies. A sizable area of volcanic flows is present in the Virginia City area. Numerous small outcrops of flows are scattered throughout the area.

Volcaniclastic material, such as tuff and breccia, is a major constituent of the Tertiary sedimentary beds that fill the basins of the area. Some of the volcanic material is mixed with erosional debris, and some is relatively pure ash or breccia. Thickness of the basin-fill material is largely unknown, but it may be thousands of feet in some areas. For the most part, these Tertiary beds are covered by Quaternary terrace or fan deposits, but outcrops are commonly present along the scarps separating terrace levels and at other places where erosion has cut stream valleys into them. The hilly topography surrounding Ledford and Sweetwater Creeks, for example, is characterized by many outcrops. Most of the rocks that crop out in the basin areas are very poorly consolidated or unconsolidated, have fine to medium texture, and tend to be light colored. These features are apparently characteristic of the late phases of volcanic activity in the area because coarse, consolidated materials of volcanic origin are common in the deeply eroded mountain areas.

Pleistocene sediment in the area typically is unsorted or poorly sorted morainal material and gravelly outwash associated with valley glaciers that occupied the higher mountain valleys. Finer textured sediment that was carried into the basins as outwash is not a prominent constituent of the sedimentary section and probably is not commonly distinguished from the older Tertiary material or younger alluvial sediment. Many of the higher terraces associated with the major streams of

the area are probably of late Pleistocene age and are blanketed by coarse sediment such as sand and cobbly gravel. These materials were the coarse fraction of glacial outwash and the bed load of high-gradient streams of the mountains. Material of the alluvial fans was carried there by similar streams, and the separation of Pleistocene sediment from more recent alluvium is essentially impossible without precise data such as that obtained by radiocarbon dating.

Alluvium that blankets the flood plains and lowest terraces of the streams varies from fine-textured clay and silt to sand-sized material and cobbly gravel. Composition of this sediment reflects a mixture of all of the rocks that underlie the countryside drained by the particular stream system that carried the alluvium to its present location. Weathering and abrasion have contributed to the alteration of appearance and mineralogy of the fine textured materials until their origin is most uncertain. Only the coarse fragments supply clues to the nature of the terrain from which they were derived.

Major fault systems bound many of the mountain ranges on at least one side. Abundant minor faulting modifies the patterns established by the major faults. Both normal and reverse faulting can be identified among major and minor faults alike.

A series of en echelon faults mapped as the Madison Range fault system bounds the Madison Range on the west. Numerous normal and reverse faults cut across the mountains in a transverse pattern. Some adjustment is still taking place in the Madison Range, as was illustrated by the West Yellowstone earthquake of 1959. Traces of the displacement along the fault that caused that earthquake may still be seen on the slopes of the mountains on the east side of the Madison valley.

A major fault that enters the county at about the southeast corner of Section 5, Township 6 South, Range 3 East trends northwestward to about the north end of Ennis Lake. Quaternary deposits obscure it over a distance of about 9 miles, but it reappears and swings northward for another 8 miles. This fault is traceable over a total distance of about 35 miles in both Madison and Park Counties.

The Gravelly Range is made up of a complex of fault blocks resulting from both normal and reverse faults. The east flank of the range has been uplifted most. Its uplift probably is the result of thrust faulting, but alluvial fans obscure any evidence that might be used to prove the nature of the displacement.

Although no faulting is mapped along the west front of the Ruby Range, it is likely that the linear nature of the mountains is indicative of a fault-line scarp. Abundant cross-faulting that has been mapped in the mountains accounts for the complicated outcrop pattern that appears on the maps.

Most of the faulting in the Tobacco Root Mountains has been mapped as minor displacements within the body of the mountains themselves. Perhaps emplacement of the intrusive rocks has been responsible for most or all of this faulting.

Good exposures of a zone of thrust faulting may be observed along the Big Hole River, between Melrose and Twin Bridges. Several slices of exposed bedrock have been thrust upward, and there are at least six repeated exposures. The easternmost slice exposes Precambrian crystalline rocks along the north side of the road. It is probable that the feature known as the Hogback, south of the above locality, is also part of a thrust block.

This discussion is only a brief sketch of the faulting in the survey area, but it points out the important role of fault displacements in the development of the topography of the area. If so many of the mountain fronts were not obscured by fan deposits, it is almost certain that many more faults could be mapped and that the structure of the mountains could be more accurately outlined. Seismic information in the files of oil companies could supply important data.

Wherever the rocks in the mountain ranges are exposed, abundant complex folding can be mapped. In this survey area, most of the folding has been obscured by Quaternary deposits. The area bordered by the Jefferson River along the northern boundary of the county is an exception. In this area extensive outcrops of Paleozoic and Mesozoic rocks crop out in complexly folded patterns. It is not unlikely that similar patterns have been buried beneath Quaternary materials.

Some of the profound deformation involved in the building of mountain topography has been briefly described above. Field observation of the rock outcrops is the only way to truly appreciate the intricacy of mountain structure, and even those observations are too often frustrated by areas of cover that obscure critical outcrops from view.

Mineral Resources and Water Supplies

By Clifford A. Balster, geologist.

The survey area has had an abundant share of natural resources. Discovery of placer gold in Alder Gulch not only started Montana's first real gold rush, it also initiated a long history of rich mineral production in Madison County. Alder Gulch alone has been credited with producing more than a million ounces of gold, and

nearby underground workings added to that total. Total gold production from Madison County has amounted to more than twice that of any other county in the state, and several properties are still producing or have recently produced.

Both high grade talc and chlorite are being produced from open-pit mines at the present time. Industrial uses and the cosmetic industry consume most of the production from these mines. Reserves and economics seem to indicate that production should continue from the operating mines, and perhap new prospects will be developed.

Small independent operators are the most active miners of metallic minerals, and therefore the present status of production is difficult to assess. Within the past 5 years, silver, lead, zinc, and minor amounts of antimony and copper have been produced. Many properties are being developed or explored, but the success of each effort depends on economics and regulatory constraints.

Metallic minerals that have been produced in the past are gold, silver, lead, zinc, tungsten, and minor amounts of copper and manganese. Phosphate and gypsum have been the most important nonmetallic minerals produced. A small coal mine near the headwaters of Coal Creek, in the upper reaches of the Ruby River system, produced a small amount of coal from the Eagle Formation (Cretaceous). No other coal resources are known within the area.

Available markets, price, regulatory constraints, and cost of operation determine the viability of a mining enterprise. Future potential, of course, also depends upon these factors. There are known deposits of garnet, tellurium, vermiculite, asbestos, and pegmatite minerals that could become economically producible in the future.

The petroleum industry has shown some interest in the Madison County area during recent years. Drilling has been very sparse and potential for finding oil is difficult to predict, but it seems likely that exploration will continue. If reserves are established, they will most likely be substantial.

Some exploration for uranium has been conducted in the past with mixed results. Some limited deposits were found in the upper part of the Ruby River drainageway, but the sharp drop in price in the mid-1970's resulted in an abrupt halt to the search.

It seems almost certain that the survey area will have a bright future in resource development. In the past mining has contributed a large fraction to the economic base of the area. Future economics, of course, will determine the extent of exploration activity, development, and production.

Water is a resource that is important throughout the state of Montana. The survey area has a relative abundance of good quality surface water that is supplied by the numerous perennial streams that rise in the mountains and provide the volume of outflow that leaves the area via the Madison and Jefferson River systems. Large quantities of irrigation water are provided by surface waters of the area and are usually distributed to the agricultural lands by systems of open ditches.

Household supplies and stock water are usually provided by springs or shallow wells. Coarse alluvium of flood plains, terraces, and fans provide the greatest percentage of domestic water, but in some areas Tertiary sandstones are dependable aquifers. There are no known populated areas within the county where an adequate supply of good quality domestic water is not available.

Water available to wells in the Ruby River drainageway is estimated to be about 35,000 acre-feet. Wells range from 33 to 155 feet in depth and can be expected to yield 10 to 30 gallons per minute.

Some of the Madison River drainageway lies outside of the survey area, and therefore the following estimates will be slightly too large because the available information is for the entire valley. It is estimated that ground water in storage and available to wells in the Madison River Valley is about 260,000 acre-feet. Wells range from 41 to 620 feet in depth and can be expected to yield 12 to 60 gallons per minute. Some wells in the middle of the lower valley may have a potential yield as high as 1,000 gallons per minute.

All ground water in Madison County is of excellent quality for all uses. Total hardness rarely exceeds 500 parts per million total dissolved solids, and the ratio of sodium to calcium can be expected to be satisfactory for all irrigation uses. Ground water has not been extensively used for irrigation, but the resource is available.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

In this survey area summers are warm and dry in the large intermontane valleys but are much cooler in the mountains. Winters are cold, and a deep snowpack accumulates in the higher mountains. Snowmelt usually supplies much more water than can be used for

agriculture in the area. In the valleys precipitation in summer falls as showers; some thunderstorms occur, mainly in May and June. In winter the ground is covered with snow much of the time. Warm, dry chinook winds blow down the valleys and cause the snow to melt and evaporate.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Alder, Ennis, Twin Bridges, and Virginia City, Montana, for the period 1951-78. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperatures at Alder, Ennis, Twin Bridges, and Virginia City are 24, 26, 25, and 24 degrees F, respectively. The average daily minimum temperature is 14 degrees at Alder, 16 degrees at Ennis, 13 degrees at Twin Bridges, and 14 degrees at Virginia City. The lowest temperature, which occurred at Virginia City on January 19, 1963, is -40 degrees. In summer the average temperature is 60 degrees at Alder and 62 degrees at Ennis, Twin Bridges, and Virginia City. The average daily maximum temperature is about 78 degrees. The highest recorded temperature, which occurred at Twin Bridges on July 20, 1960, is 100 degrees.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 13 inches at Alder, 12 inches at Ennis, 9 inches at Twin Bridges, and 16 inches at Virginia City. Of this, 75 percent usually falls in April through September, which includes the growing season for most crops; however, the rainfall during the growing season generally is not sufficient to ensure a successful crop in most years. A crop-fallow system is used for areas of nonirrigated small grain crops. The heaviest 1-day rainfall during the period of record was 2.65 inches at Ennis on August 12, 1969. Thunderstorms occur on about 30 days each year, and most occur late in spring and early summer.

Average seasonal snowfall is 45 inches at Alder, 30 inches at Ennis, 19 inches at Twin Bridges, and 65 inches at Virginia City. The greatest snow depth at any one time during the period was 16 inches at Virginia City. On the average, for 2 days at Alder and Ennis, 9 days at Twin Bridges, and 29 days at Virginia City there is at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 75 percent of the time possible in summer and 50 percent in winter.

The prevailing wind is from the west. Average windspeed is highest, 9 miles per hour, in spring. Strong, gusty winds are common year round, particularly in Madison Valley. These winds sometimes blow for days at a time. In summer warm, dry winds can rapidly dry out the surface layer, which subjects some of the soils in the survey area to a severe hazard of soil blowing. In winter winds from the north may accompany cold arctic air, which can result in a windchill factor well below zero. Drifting of snow is a concern in years of normal or above-normal snowfall.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually onto one another as their characteristics gradually change. To construct an accurate map,

however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Map Unit Descriptions

Soils on flood plains and terraces

This group consists of one map unit. It makes up 7.5 percent of the survey area. Elevation is 4,200 to 6,000 feet. The average annual precipitation is 10 to 14 inches. The average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

The soils in this group are nearly level to gently sloping, deep, and somewhat poorly drained and well drained. They formed in alluvium.

This group is used mainly as irrigated cropland, as rangeland, and as irrigated hayland and pastureland. Some areas are also used as wildlife habitat.

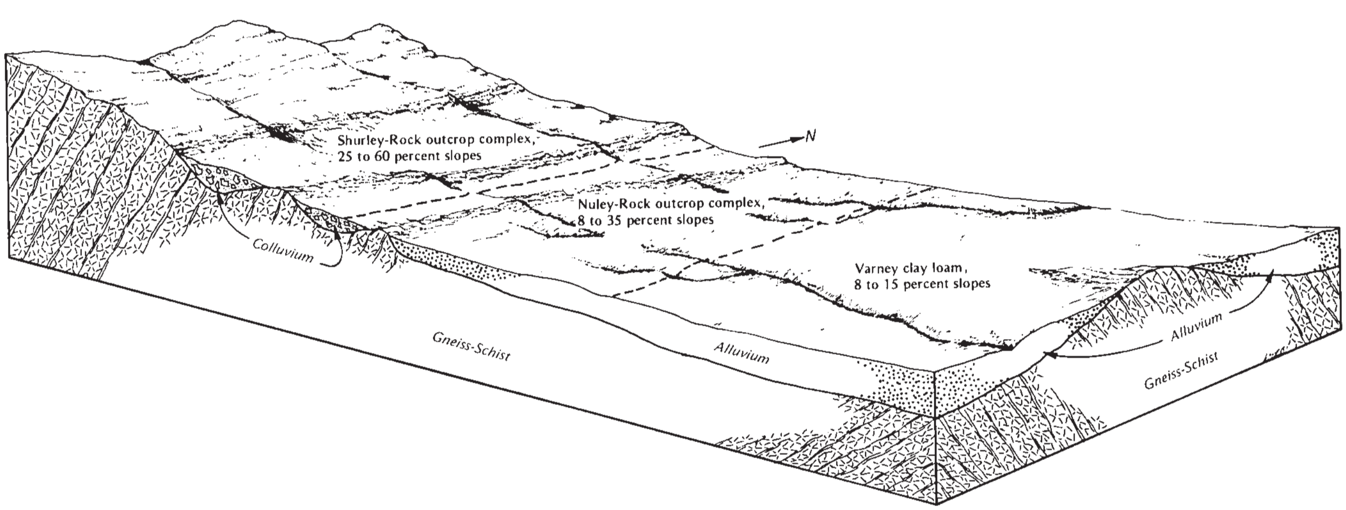


Figure 1.—Typical area of general soil map unit 3, showing the relationship of the detailed soil map units, topography, and geology.

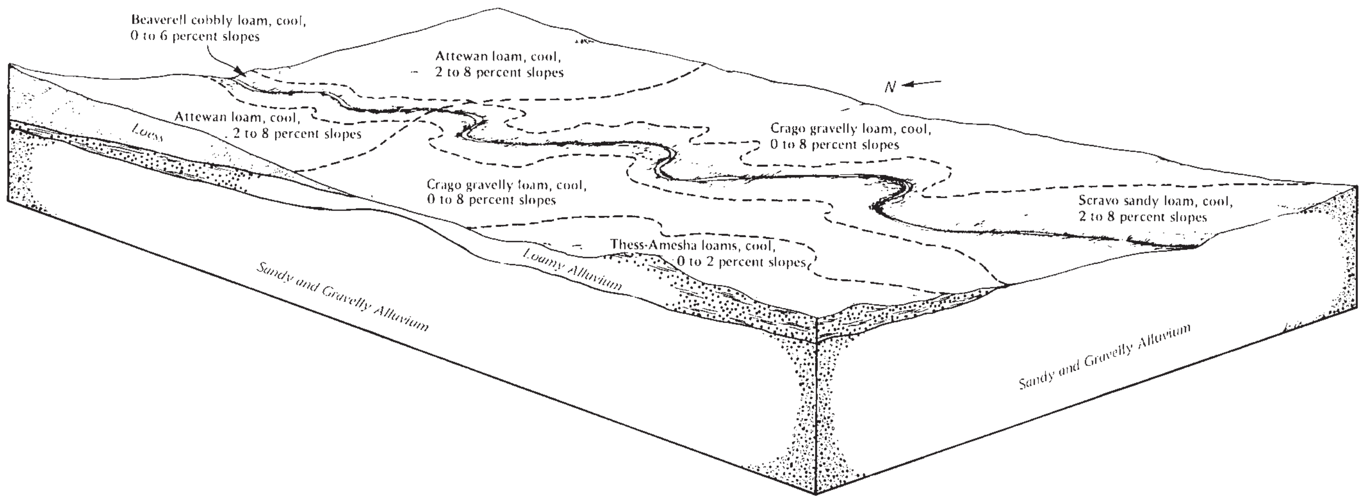


Figure 2.—Typical area of general soil map unit 4, showing the relationship of the detailed soil map units, topography, and parent material.

1. Havre-Rivra-Neen

Nearly level to gently sloping, deep, well drained and somewhat poorly drained soils; on flood plains and low terraces

This map unit is mainly in areas adjacent to the Madison, Ruby, Beaverhead, and Big Hole Rivers. It makes up about 7.5 percent of the survey area.

The Havre, Rivra, and Neen soils are typical of the kinds of soil in this unit. These soils formed in alluvium.

This unit is used as irrigated cropland, as rangeland, as irrigated hayland and pastureland, and as wildlife habitat.

Soils on semiarid uplands

This group consists of four map units. It makes up 44.5 percent of the survey area. Elevation is 4,300 to 6,500 feet. The average annual precipitation is 10 to 14 inches. The average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

The soils in this group are nearly level to very steep, deep, and well drained and somewhat excessively drained. They formed in alluvial and eolian material and in material derived from igneous or metamorphic rock.

This group is used mainly as rangeland. Some areas are also used as irrigated and nonirrigated cropland, as irrigated hayland and pastureland, and as wildlife habitat.

2. Kalsted-Brocko

Nearly level to steep, deep, well drained soils; on fans, terraces, and hills

This map unit is mainly in areas near Harrison, but there are several small, scattered areas in the western part of the survey area. The unit makes up about 6 percent of the area.

The Kalsted and Brocko soils are typical of the kinds of soil in this unit. These soils formed in alluvial and eolian material.

This unit is used mainly as irrigated and nonirrigated cropland. It is also used as rangeland.

3. Varney-Nuley-Shurley

Gently sloping to very steep, deep, well drained soils; on fans, terraces, foot slopes, and hills

This map unit is mainly in areas north of Norris and northwest of Twin Bridges, but there are several smaller areas scattered across the central part of the survey area (fig. 1). The unit makes up about 12.5 percent of the area.

The Varney, Nuley, and Shurley soils are typical of the kinds of soil in this unit. These soils formed in alluvium and in material derived from igneous and metamorphic rock.

This unit is used as rangeland, as irrigated and nonirrigated cropland, as irrigated hayland and pastureland, and as wildlife habitat.

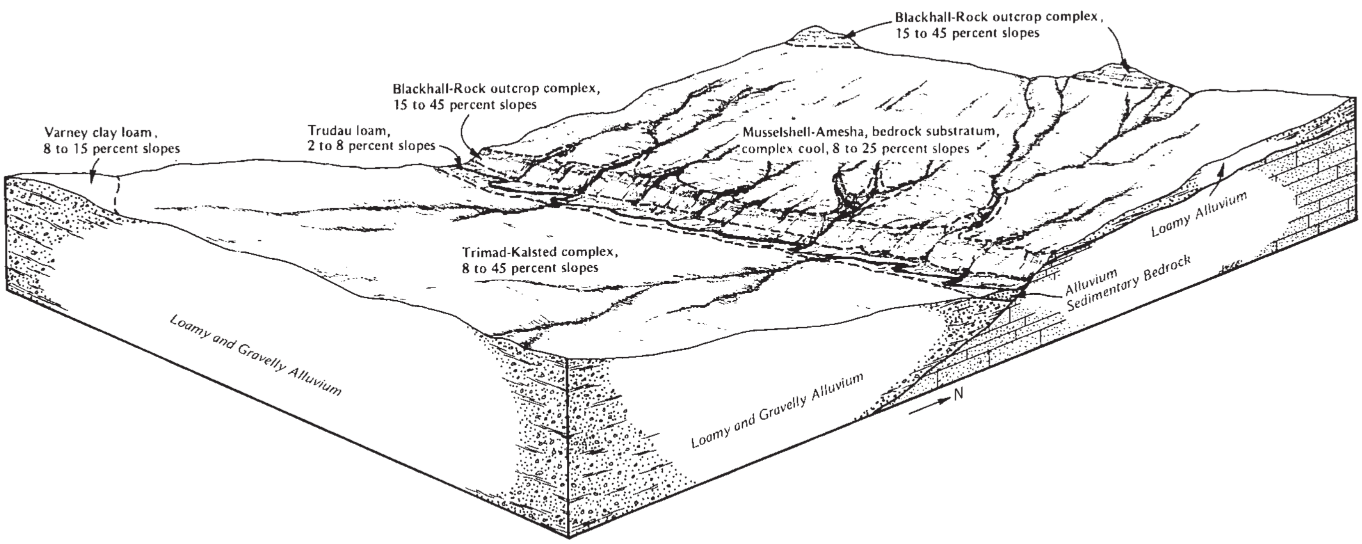


Figure 3.—Typical area of general soil map unit 5, showing the relationship of the detailed soil map units, topography, parent material, and geology.

4. Crago-Scravo-Attewan

Nearly level to steep, deep, well drained, gravelly soils; on fans, terraces, and hills

This map unit is mainly in areas around and south of Ennis and east and south of Twin Bridges (fig. 2). It makes up about 15 percent of the survey area.

The Crago, Scravo, and Attewan soils are typical of the kinds of soil in this unit. These soils formed in gravelly alluvium.

This unit is used as rangeland, as irrigated and nonirrigated cropland, as irrigated hayland and pastureland, and as wildlife habitat.

5. Musselshell-Trimad-Amesha

Nearly level to steep, deep, well drained, loamy soils; on fans and terraces

This map unit is in areas scattered throughout the western part of the survey area (fig. 3). It makes up about 11 percent of the area.

The Musselshell, Trimad, and Amesha soils are typical of the kinds of soil in this unit. These soils formed in alluvial and eolian material.

This unit is used as rangeland, as irrigated hayland and pastureland, as nonirrigated and irrigated cropland, and as wildlife habitat.

Soils on subhumid uplands

This group consists of four map units. It makes up 30 percent of the survey area. Elevation is 5,000 to 8,000 feet. The average annual precipitation is mainly 15 to 19 inches. The average annual air temperature is 34 to 40 degrees F, and the frost-free period is 60 to 90 days.

The soils in this group are nearly level to very steep, shallow to deep, and well drained. They formed in alluvium, colluvium, glacial till, and eolian material and in material derived from igneous and metamorphic rock.

This group is used mainly as rangeland. Some areas are also used as irrigated and nonirrigated hayland and pastureland and as wildlife habitat.

6. Oro Fino-Poin-Hapgood

Gently sloping to very steep, shallow and deep, well drained soils; on fans, foot slopes, glacial moraines, and hillsides on uplands

This map unit is in areas scattered throughout most of the survey area (fig. 4). It makes up about 22 percent of the area.

The Oro Fino, Poin, and Hapgood soils are typical of the kinds of soil in this unit. These soils formed in colluvium, alluvium, and glacial till and in material derived from igneous and metamorphic rock.

This unit is used mainly as rangeland and wildlife

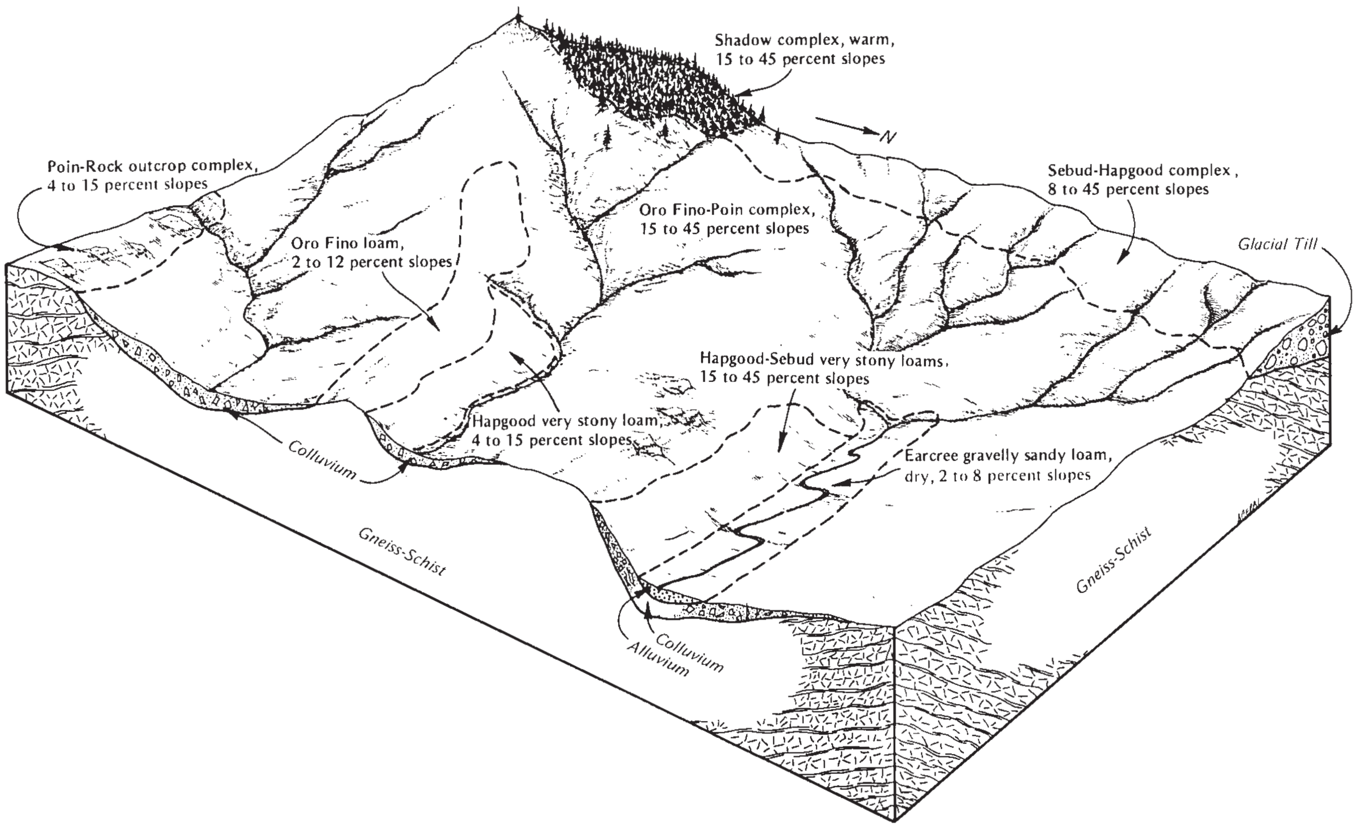


Figure 4.—Typical area of general soil map unit 6, showing the relationship of the detailed soil map units, topography, and geology.

habitat. Some areas are also used as irrigated and nonirrigated hayland and pastureland.

7. Woodhall-Libeg-Hapgood

Gently sloping to very steep, moderately deep and deep, well drained soils; on fans, foot slopes, glacial moraines, benches, and hills

This map unit is mainly in areas in the southern part of Madison Valley. It makes up about 2.5 percent of the survey area.

The Woodhall, Libeg, and Hapgood soils are typical of the kinds of soil in this unit. These soils formed in colluvium, alluvium, and glacial till and in material derived from igneous and metamorphic rock.

This unit is used mainly as rangeland and wildlife habitat.

8. Bridger-Hanson

Gently sloping to steep, deep, well drained soils; on fans, foot slopes, glacial moraines, and hillsides

This map unit is mainly in areas in the northeastern and southwestern parts of the survey area. It makes up about 2 percent of the area.

The Bridger and Hanson soils are typical of the kinds of soil in this unit. These soils formed in alluvium, colluvium, and glacial till.

This unit is used mainly as rangeland and wildlife habitat.

9. Leavitt-Maxville-Bearmouth

Nearly level to moderately steep, deep, well drained soils; on terraces, fans, and foot slopes on uplands

This map unit is mainly in areas in the southeastern part of the survey area (fig. 5). It makes up about 3.5 percent of the area.

The Leavitt, Maxville, and Bearmouth soils are typical of the kinds of soil in this unit. These soils formed in alluvial and eolian material.

This unit is used mainly as rangeland and wildlife habitat. Some areas are used as irrigated and

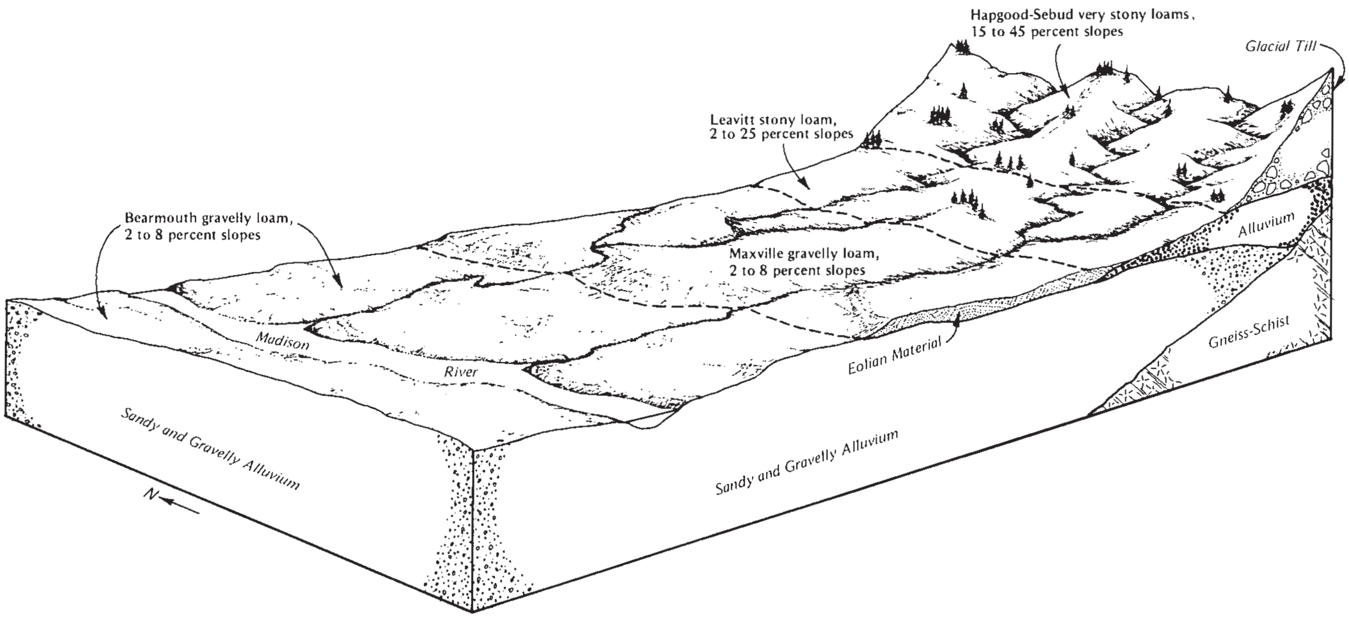


Figure 5.—Typical area of general soil map unit 9, showing the relationship of the detailed soil map units, topography, and parent material.

nonirrigated hayland and pastureland.

Soils on mountains

This group consists of four map units. It makes up 18 percent of the survey area. Elevation is 5,000 to 9,500 feet. The average annual precipitation is 15 to 50 inches. The average annual air temperature is 30 to 42 degrees F, and the frost-free period is less than 105 days.

The soils in this group are gently sloping to very steep, deep, and well drained to excessively drained. They formed in colluvium, glacial till, and alluvium and in material derived from shale.

This group is used mainly as woodland, for understory grazing, and as wildlife habitat. Some areas are used as rangeland.

10. Mikesell-Shadow-Worock

Strongly sloping to very steep, deep, well drained and somewhat excessively drained soils; on mountain slopes, foot slopes, glacial moraines, and terraces

This map unit is mainly in areas in the Madison Range, just north of Lone Mountain and south of Sphinx Mountain. It makes up about 4.5 percent of the survey area.

The Mikesell, Shadow, and Worock soils are typical of the kinds of soil in this unit. These soils formed in colluvium, glacial till, and alluvium and in material derived from shale.

This unit is used mainly as woodland, for understory grazing, and as wildlife habitat.

11. Whitore-Hanson-Rock outcrop

Gently sloping to very steep, deep, well drained soils, and Rock outcrop; on foot slopes, mountain slopes, glacial moraines, and hillsides

This map unit is in areas scattered throughout most of the survey area (fig. 6). It makes up about 7.5 percent of the area.

The Whitore and Hanson soils are typical of the kinds of soil in this unit. These soils formed in highly calcareous colluvium, alluvium, and glacial till. There are also areas of Rock outcrop.

This unit is used mainly as woodland, for understory grazing, as rangeland, and as wildlife habitat.

12. Rock outcrop-Garlet

Rock outcrop and moderately steep to very steep, deep, well drained soils; on mountain slopes and glacial moraines

This map unit is in several scattered areas of the Madison Range. It makes up about 2.5 percent of the area.

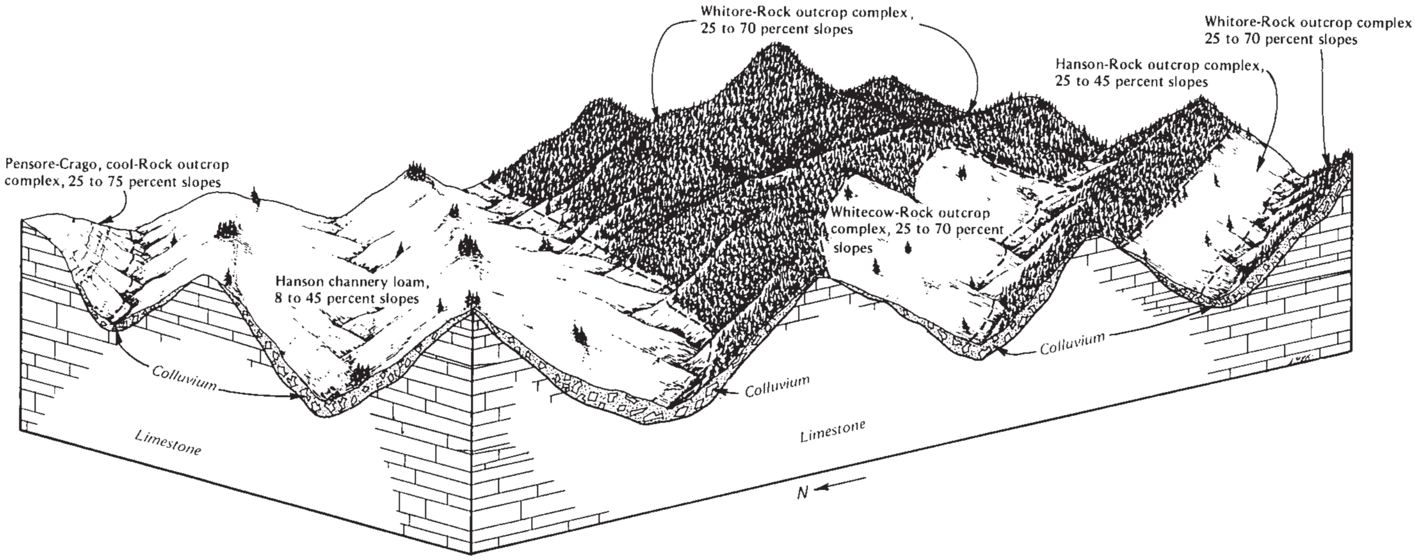


Figure 6.—Typical area of general soil map unit 11, showing the relationship of the detailed soil map units, topography, and geology.

The Garlet soils are typical of the kinds of soil in this unit. These soils formed in colluvium and glacial till. Much of the area of this unit is Rock outcrop.

This unit is used mainly as woodland, for understory grazing, and as wildlife habitat.

13. Shadow-Rochester-MacFarlane

Moderately steep to very steep, deep, well drained, somewhat excessively drained, and excessively drained soils; on mountain slopes, hillsides, and glacial moraines

This map unit is in areas around McCartney Mountain in the western part of the survey area and south of Virginia City. Several smaller areas are scattered in the northeastern part of the survey area. The unit makes up about 3.5 percent of the survey area.

The Shadow, Rochester, and MacFarlane soils are typical of the kinds of soil in this unit. These soils formed in colluvium and glacial till.

This unit is used mainly as woodland, for understory grazing, and as wildlife habitat.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavior divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps.

The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation to precisely define and locate the soils and miscellaneous areas is needed.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying layers, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Scravo sandy loam, cool, 2 to 8 percent slopes, is one of several phases in the Scravo series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Libeg-Adel complex, 4 to 25 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Badland is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

1—Adel loam, 0 to 4 percent slopes. This deep, well drained soil is on fans and terraces and in swales on uplands. It formed in alluvial and eolian material. Slope is 0 to 4 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Typically, the surface layer is mainly very dark grayish brown loam about 37 inches thick. The subsoil to a depth of 60 inches or more is grayish brown and brown loam.

Included in this unit are small areas of poorly drained soils and soils that have a gravelly or stony surface layer. Included areas make up about 10 percent of the total acreage.

Permeability of this Adel soil is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated pasture and as rangeland. It is also used for irrigated alfalfa hay and grass-legume hay.

Cropland management. This unit is suited to nonirrigated pasture and hay. It is limited mainly by the short growing season. Soil blowing is a hazard when the soil is tilled for seedbed preparation and planting. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is suited to the soil in this unit. Contour ditch irrigation is also suitable. The unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly basin wildrye, Richardson needlegrass, Idaho fescue, mountain brome, mountain big sagebrush, bluebunch wheatgrass, and rough fescue. If the rangeland is overgrazed, the proportion of basin wildrye, Richardson needlegrass, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and other perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. In places, brush control improves production of desirable forage plants.

Windbreak management. This unit is well suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. The main limitations for homesite development on this unit are the moderate permeability, potential frost action, and low soil strength. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

2—Adel loam, 4 to 15 percent slopes. This deep, well drained soil is on fans, foot slopes, and hillsides. It formed in alluvial and eolian material. Slope is 4 to 15 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the

average frost-free period is about 75 days.

Typically, the surface layer is mainly very dark grayish brown loam about 37 inches thick. The subsoil to a depth of 60 inches or more is grayish brown and brown loam.

Included in this unit are small areas of soils that have a gravelly or stony surface layer or that have a calcareous substratum. Included areas make up about 15 percent of the total acreage.

Permeability of this Adel soil is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated pasture and as rangeland. It is also used for irrigated grass-legume hay.

Cropland management. This unit is suited to nonirrigated pasture and hay. It is limited mainly by the short growing season. Soil blowing and water erosion are hazards and runoff is a problem when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and the risk of water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly basin wildrye, Richardson needlegrass, Idaho fescue, mountain brome, mountain big sagebrush, bluebunch wheatgrass, and rough fescue. If the rangeland is overgrazed, the proportion of basin wildrye, Richardson needlegrass, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and other perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. In places, brush control improves production of desirable forage plants.

Windbreak management. This unit is well suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. The main limitations for homesite development on this unit are slope, moderate permeability, potential frost action, and low soil strength. If the soil is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Frost action and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

3—Amesha loam, cool, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the northwestern part of the survey area. It formed in calcareous alluvium. Slope is 2 to 8 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Typically, the surface layer is light brownish gray loam 7 inches thick. The upper 9 inches of the underlying material is white loam, and the lower part to a depth of 60 inches or more is light gray loam.

Included in this unit are small areas of Crago and Musselshell soils. These soils are mainly along intermittent drainageways and on slope breaks. Also included are small areas of Kalsted soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Amesha soil is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used for nonirrigated and irrigated crops,

as rangeland, and for pasture. The main irrigated crops are alfalfa for hay and grass and legumes for pasture. Small grain is also grown in some areas. The main nonirrigated crops are small grain and grass for pasture.

Cropland management. If this unit is used for irrigated crops, it is limited by the hazards of water erosion and soil blowing. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion.

If this unit is used for nonirrigated crops, it is limited by the hazards of soil blowing and water erosion and medium runoff. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; stubble mulch tillage; and growing sod crops such as hay and pasture. Soil blowing can be reduced by planting crops in alternate strips and at right angle to the prevailing wind. If the soil is cultivated, fall plowing should be avoided to minimize soil blowing.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The high content of lime in the soil limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It has few limitations. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

4—Amesha loam, cool, bedrock substratum, 8 to 25 percent slopes. This deep, well drained soil is on uplands in the southern part of the Ruby Valley. It formed in alluvium derived from soft, loamy sedimentary beds. Slope is 8 to 25 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Typically, the surface layer is grayish brown loam about 8 inches thick. The upper 27 inches of the underlying material is light gray loam, and the lower part to a depth of about 52 inches is loam with thin strata of silt loam and sandy loam. Below this depth are loamy sedimentary beds. Soft, loamy sedimentary beds are at a depth of 40 to 60 inches or more.

Included in this unit are small areas of Blackhall, Trudau, and Musselshell soils. Also included are small areas of soft, sedimentary Rock outcrop. The shallow Blackhall soils and the areas of Rock outcrop are on the sides and crests of hills. The Musselshell soils are on hilltops, and the salt- and sodium-affected Trudau soils are on foot slopes and along intermittent drainageways. Included areas make up about 15 percent of the total acreage.

Permeability of this Amesha soil is moderate. Available water capacity is about 7 inches. Effective rooting depth is restricted by the depth to sedimentary beds. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used as rangeland. It is poorly suited to cultivated crops because of steepness of slope.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass,

needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. The surface layer of the soil is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is not suited to windbreaks. It is limited mainly by the steepness of slope.

Homesite development. If this unit is used for homesite development, it is limited mainly by slope, moderate permeability, and depth to soft, loamy sedimentary beds. If the soil is used for septic tank absorption fields, the limitations of moderate permeability and depth to sedimentary beds can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Effluent from absorption fields can surface in downslope areas and create a hazard to health.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

5—Amesha, bedrock substratum-Musselshell complex, cool, 2 to 8 percent slopes. This map unit is on dissected terraces in the upper part of the Ruby Valley. Slope is 2 to 8 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 50 percent Amesha loam and 30 percent Musselshell gravelly loam. The Amesha soil is mainly on ridges and convex slope breaks, and the Musselshell soil is in intermittent drainageways and on concave slope breaks.

Included in this unit are small areas of Trimad, Blackhall, and Varney soils. The Blackhall soils are on ridges and steep terrace breaks. The Trimad and Varney soils are randomly distributed throughout the unit. Included areas make up about 20 percent of the total acreage.

The Amesha soil is deep and well drained. It formed in alluvium derived from soft, loamy sedimentary beds. Typically, the surface layer is grayish brown loam about 8 inches thick. The upper 27 inches of the underlying material is light gray loam, and the lower part to a depth of about 52 inches is loam with thin strata of silt loam and sandy loam. Below this depth are loamy sedimentary beds. Soft, loamy sedimentary beds are at a depth of 40 to 60 inches or more.

Permeability of the Amesha soil is moderate. Available water capacity is about 7 inches. Effective rooting depth is 40 to 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

The Musselshell soil is deep and well drained. It formed in alluvial and eolian material derived mainly from limestone. Typically, the surface layer is light brownish gray gravelly loam 8 inches thick. The upper 17 inches of the underlying material is white loam, and the lower part to a depth of 60 inches or more is light gray very gravelly loam.

Permeability of the Musselshell soil is moderate to a depth of about 25 inches and moderately rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used mainly as rangeland. Some small areas are used for nonirrigated pasture.

This unit is suited to irrigated and nonirrigated hay and small grain. It is limited mainly by the hazards of water erosion and soil blowing and droughtiness. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Farming on the contour or across the slope, where practical, reduces runoff and water erosion and helps to control soil blowing. Because of droughtiness, successful crop production is dependent on receiving average or above average rainfall during the early part of the growing season. Conservation practices that help to conserve moisture are minimum tillage, using tall grass barriers, stripcropping, and stubble mulch tillage.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass,

needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. The hazard of soil blowing is a concern when preparing the seedbed for grass.

Windbreak management. The soils in this unit are suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. Under irrigation this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. The Amesha soil is suited to homesite development. It is limited mainly by depth to soft, loamy sedimentary beds and moderate permeability. Deep cuts needed to provide nearly level road surfaces can expose the sedimentary beds that can easily be excavated. If this soil is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field.

The Musselshell soil is suited to homesite development. It has few limitations.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

6—Amsterdam silty clay loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and gently rolling hills in the northeastern part of the survey area. It formed in silty lacustrine and eolian material. Slope is 2 to 8 percent. Elevation is 4,800 to 5,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 95 days.

Typically, the surface layer is dark grayish brown silty clay loam 5 inches thick. The subsoil is dark brown silty clay loam 6 inches thick. The upper 23 inches of the substratum is light gray and white silt loam, and the lower part to a depth of 60 inches or more is white very fine sandy loam.

Included in this unit are small areas of eroded soils. These soils are on ridgetops and knolls and are less productive than this Amsterdam soil. Also included are small areas of very gravelly soils; deep, dark-colored soils; clayey soils; soft siltstone outcroppings; and soils that have soft siltstone at a depth of 20 inches or less. The very gravelly soils are adjacent to rock outcroppings on uplands. The deep, dark-colored soils are in drainageways and in swales. The clayey soils, areas of soft siltstone outcroppings, and the soils that have soft siltstone at a shallow depth occur randomly throughout the unit. Included areas make up about 15 percent of the total acreage.

Permeability is moderately slow to a depth of 34 inches and moderate below this depth. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

Most areas of this unit are used as nonirrigated cropland. A few areas are used as rangeland, as irrigated cropland, and for irrigated hay and pasture. The main crop is small grain.

Cropland management. If this unit is used for cultivated crops, it is limited by runoff and the hazards of soil blowing and water erosion. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. These practices can also reduce runoff. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion. This unit is suited to nonirrigated pasture and to irrigated pasture, small grain, and hay crops. Sprinkler irrigation is the most suitable method of applying water.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community

produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition.

Windbreak management. This unit is well suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. This unit is suited to homesite development. The main limitations are the moderately slow permeability, potential frost action, and low soil strength. If the soil in this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated and irrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

7—Amsterdam-Brocko Variant complex, 8 to 15 percent slopes. This map unit is on strongly rolling hills in the northeastern part of the survey area. Slope is 8 to 15 percent. Elevation is 4,800 to 5,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 95 days.

This unit is about 60 percent Amsterdam silty clay loam and 25 percent Brocko Variant silt loam. The Amsterdam soil is on side slopes and in swales, and the Brocko Variant soil is on ridges, knolls, and the steeper parts of the unit.

Included in this unit are small areas of very gravelly soils, outcroppings of soft siltstone, and soils that have slopes of more than 15 percent. These areas occur randomly throughout the unit. These areas make up about 15 percent of the total acreage.

The Amsterdam soil is deep and well drained. It formed in silty lacustrine and eolian material. Typically, the surface layer is dark grayish brown silty clay loam 5 inches thick. The subsoil is dark brown silty clay loam 6 inches thick. The upper 23 inches of the substratum is light gray and white silt loam, and the lower part to a depth of 60 inches or more is white very fine sandy loam.

Permeability of the Amsterdam soil is moderately slow. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Brocko Variant soil is deep and well drained. It formed in lacustrine and eolian material. Typically, the surface layer is light brownish gray silt loam 5 inches thick. The upper 18 inches of the underlying material is light gray silty clay loam, and the lower part to a depth of 60 inches or more is white silt loam.

Permeability is moderate. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

Most areas of this unit are used as nonirrigated cropland. A few areas are used as rangeland and for irrigated hay and pasture. The main nonirrigated crop is small grain. The main irrigated crops are alfalfa and grass for hay and pasture.

Cropland management. If this unit is used for cultivated crops, it is limited by runoff and the hazards of soil blowing and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. These practices can also reduce runoff. Farming on the contour or across the slope, where practical, reduces erosion. Growing grasses and legumes for hay and pasture also reduces soil blowing and erosion. The surface layer of the Brocko Variant soil is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. If this unit is cultivated, fall plowing should be avoided to reduce the risk of soil blowing.

Rangeland management. The potential native plant

community on this unit is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition.

Windbreak management. The Amsterdam soil is well suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

The Brocko Variant soil is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. The main limitations for homesite development on this unit are slope, restricted permeability, potential frost action, and the low soil strength of the Amsterdam soil. If this unit is used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Frost action and the low strength of the Amsterdam soil can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Excavation for roads can expose material that is highly susceptible to water erosion. Making low gradient cuts and fills and establishing a suitable plant cover reduce water erosion.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

8—Aquic Cryoboralfs-Typic Cryochrepts complex, 4 to 15 percent slopes. This map unit is in glaciated basins in the mountains near the Madison-Gallatin divide. Slope is 4 to 15 percent. Elevation is 8,500 to 9,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 34 degrees F, and the average frost-free period is about 45 days. Frost may occur at any time during summer.

This unit is about 50 percent Aquic Cryoboralfs and 30 percent Typic Cryochrepts.

Included in this unit are small areas of Cryoborolls, organic soils, and Rock outcrop. The Cryoborolls are similar to these Aquic Cryoboralfs and Typic Cryochrepts but they have a dark-colored surface layer. The organic soils consist of 2 to 3 feet of organic material over bedrock or partly weathered shale. They are saturated with water most of the year and support mainly sedges and willows. The Rock outcrop is mainly sandstone and andesite. Included areas make up about 20 percent of the total acreage.

The Aquic Cryoboralfs are mainly moderately deep and poorly drained. They formed in material derived from clayey shale. These soils have a surface layer of loam or clay loam. The subsoil is clay. The substratum is clay loam or clay and has prominent yellow and yellowish brown mottles. Depth to shale is 20 to 40 inches.

Permeability of the Aquic Cryoboralfs is slow. The melting of winter snow accumulations keeps these soils wet through early in summer in most years. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Typic Cryochrepts are mainly moderately deep and well drained. They formed in material derived from sandstone, loamy shale, and andesite. These soils range from sandy loam to clay loam and have varying amounts of rock fragments. Sandstone or andesite is at a depth of 20 to 50 inches.

Permeability of the Typic Cryochrepts is moderate. Effective rooting depth is 20 to 50 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used mainly for recreation and wildlife habitat. They are also used as rangeland.

Rangeland management. The potential native plant community on the Aquic Cryoboralfs is mainly tall reedgrasses, tufted hairgrass, alpine timothy, sedges, blue eyegrass, sulphur cinquefoil, shrubby cinquefoil, and willow. If the rangeland is overgrazed, the proportion of tall reedgrasses, tufted hairgrass, and alpine timothy decreases and the proportion of sedges,

blue eyegrass, sulphur cinquefoil, shrubby cinquefoil, and willow increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces 5,000 to 6,000 pounds of air-dry vegetation per acre per year, depending on the length and temperature of the growing period.

The potential native plant community on the Typic Cryochrepts is mainly spike fescue, alpine bluegrass, tufted hairgrass, sedges, lupine, cinquefoil, and alpine timothy. If the rangeland is overgrazed, the proportion of spike fescue, alpine bluegrass, tufted hairgrass, and alpine timothy decreases and the proportion of cinquefoil, sedges, and shrubby cinquefoil increases. If overgrazing continues, plants such as Kentucky bluegrass may invade. The potential native plant community produces 1,500 to 3,000 pounds of air-dry vegetation per acre per year, depending on the length and temperature of the growing period. Small percentages of other plants include scattered whitebark pine and subalpine fir.

This map unit is in capability subclass VIe. The Aquic Cryoboralfs are in Subirrigated range site, 20- to 24-inch precipitation zone, and the Typic Cryochrepts are in Silty range site, cold, 20- to 24-inch precipitation zone.

9—Armitage-Thess, cool, complex, 0 to 4 percent slopes. This map unit is on fans and terraces in the southeastern part of the survey area. Slope is 0 to 4 percent. Elevation is 5,000 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 55 percent Armitage cobbly loam and 40 percent Thess loam.

Included in this unit is about 5 percent randomly distributed stony soils.

The Armitage soil is deep and well drained. It formed in loamy alluvium over extremely gravelly sand. Typically, the surface layer, where mixed to a depth of 5 inches, is mainly grayish brown cobbly loam. The upper 2 inches of the subsoil is pale brown clay, and the lower 6 inches is brown clay loam. The upper 23 inches of the substratum is light gray silt loam, and the lower part to a depth of 60 inches or more is pale brown extremely gravelly sand. Depth to sand and gravel is 20 to 40 inches.

Permeability is slow to a depth of about 36 inches and very rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is moderately sodium-affected and slightly salt-affected at a depth of about 5 inches.

The Thess soil is deep and well drained. It formed in loamy alluvium over very gravelly sandy alluvium. Typically, the surface layer is light brownish gray loam about 6 inches thick. The upper 24 inches of the underlying material is light brownish gray loam and fine sandy loam, and the lower part to a depth of 60 inches or more is very gravelly sand. Depth to gravelly and sandy material is mainly 20 to 30 inches but ranges from 20 to 40 inches. The soil is calcareous throughout.

Permeability is moderate to a depth of about 30 inches and very rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

Most areas of this unit are used as rangeland. A few areas are used for irrigated crops. The main irrigated crops are grass, alfalfa, and some wheat and barley.

Cropland management. This unit is poorly suited to nonirrigated crops. It is limited mainly by the low available water capacity, medium runoff, the hazards of water erosion and soil blowing, and the cobbly surface layer and high salt content of the Armitage soil. Salts can be leached from this soil with proper irrigation. Where salts are leached from the root zone, the soil is suited to irrigated crops. Salt-tolerant crops should be grown in the initial stages of reclamation. Where the Armitage soil is cultivated for the first time, tillage should be to a depth of 7 to 10 inches. This will mix the thin clay layer and allow better movement of water and growth of roots. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the soils in this unit are droughty, light and frequent applications of irrigation water are needed. Minimum tillage, contour cultivation, grassed waterways, stubble mulch tillage, and growing grasses and legumes for hay and pasture reduce soil blowing, runoff, and water erosion. The surface layer of the Thess soil is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Rock fragments in the surface layer cause rapid wear of tillage equipment.

Rangeland management. The potential native plant

community on the Armitage soil is mainly bluebunch wheatgrass, green needlegrass, needleandthread, big sagebrush, and winterfat. Small percentages of other plants including western wheatgrass are also present. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of western wheatgrass, needleandthread, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The potential native plant community on the Thess soil is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on the soils in this unit if the rangeland vegetation is in poor condition. The soils are suited to mechanical practices such as scalping, pitting, furrowing, and chiseling to improve areas of deteriorated rangeland. The surface layer of the soils is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. The Armitage soil is very poorly suited to windbreaks. It is limited mainly by the high content of salts and sodium. The Thess soil is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, these soils are also suited to lilac shrubs and blue spruce trees.

Homesite development. The main limitations for homesite development on these soils are the very rapid permeability, the underlying sand and gravel, and potential frost action. If the soils are used for septic tank absorption fields, the limitation of very rapid permeability where depth to sand and gravel is less than 25 inches can be overcome by increasing the size of the absorption field. Frost action can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation.

This map unit is in capability subclass IVe, nonirrigated and irrigated. The Armitage soil is in Silty range site, 10- to 14-inch precipitation zone, and the Thess soil is in Silty range site, limy, 10- to 14-inch precipitation zone.

10—Attewan loam, cool, 0 to 2 percent slopes. This deep, well drained soil is on terraces and the lower parts of fans in the Madison Valley. It formed in alluvium. Slope is 0 to 2 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Varney and Trimad soils. The Trimad soil is along intermittent drainageways. The Varney soil is in small depressional areas. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Attewan soil is dark grayish brown loam about 4 inches thick. The subsoil is brown clay loam about 4 inches thick. The upper 16 inches of the substratum is light brownish gray and grayish brown loam, and the lower part to a depth of 60 inches or more is very gravelly sand. Gravelly and sandy material is at a depth of 20 to 40 inches.

Permeability is moderate to a depth of about 24 inches and rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used for irrigated and nonirrigated crops, hay, and pasture and as rangeland. The main crops are wheat, barley, alfalfa, and grass. Oats are also suited to irrigated areas.

Cropland management. If this unit is used for cultivated crops, it is limited by the low available water capacity. Soil blowing is a hazard in nonirrigated areas. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control soil blowing. Suitable methods for reducing soil blowing are stripcropping, using tall grass barriers and field windbreaks, minimum tillage, stubble mulch tillage, and growing sod crops such as hay and pasture. Furrow,

border, corrugation, and sprinkler irrigation systems are suited to this unit. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the soil in this unit is droughty, light and frequent applications of irrigation water are needed. If furrow irrigation is used, water should be applied at frequent intervals and runs should be short.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. The soil is suited to mechanical practices such as scalping, pitting, furrowing, and chiseling to improve areas of deteriorated rangeland.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. The main limitations for homesite development on this unit is the rapid permeability of the very gravelly sand substratum. If the unit is used for septic tank absorption fields, the limitation of rapid permeability in areas where the substratum is at a depth of less than 25 inches can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass IIIe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

11—Attewan loam, cool, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the southeastern part of the survey area. It formed in alluvium. Slope is 2 to 8 percent. Elevation is 5,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Beaverell soils in gravelly swales and drainageways. Also included are small areas of Attewan soils that have a gravelly loam surface layer. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Attewan soil is dark grayish brown loam about 4 inches thick. The subsoil is brown clay loam about 6 inches thick. The upper 25 inches of the substratum is light brownish gray and light gray loam, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly sand. Gravelly and sandy material is at a depth of 20 to 40 inches.

Permeability is moderate to a depth of about 35 inches and rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for irrigated and nonirrigated crops, hay, and pasture and as rangeland. The main crops are wheat, barley, alfalfa, and grass. Oats is also suited to irrigated areas.

Cropland management. If this unit is used for cultivated crops, it is limited by the low available water capacity, medium runoff, and the hazard of water erosion. The hazard of soil blowing is also a limitation in nonirrigated areas. Leaving crop residue on or near the surface conserves moisture, increases the water intake rate, improves tilth, and helps to control erosion. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the soil in this unit is droughty, light and frequent applications of irrigation water are needed.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, green needlegrass, needleandthread, big sagebrush, and winterfat. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green

needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, blue grama, Sandberg bluegrass, big sagebrush, and threadleaf sedge increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, and annual forbs may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. The soil in this unit is suited to mechanical practices such as scalping, pitting, furrowing, and chiseling to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. The main limitation for homesite development on this unit is the rapid permeability of the extremely gravelly sand substratum. If the soil in this unit is used for septic tank absorption fields, the limitation of rapid permeability in areas where the substratum is at a depth of less than 25 inches can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass IIIe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

12—Attewan cobbly loam, cool, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in intermontane valleys. It formed in alluvium. Slope is 2 to 8 percent. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Beaverell, Varney, and Trimad soils. The Beaverell soils are in gravelly swales and drainageways, and the Trimad soils are along intermittent drainageways. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Attewan soil is dark grayish brown cobbly loam 4 inches thick. The subsoil is brown clay loam 7 inches thick. The upper 9 inches of the substratum is white silt loam, and the lower part to a depth of 60 inches or more is grayish brown very gravelly loamy sand. Gravelly and sandy material is at a depth of 20 to 40 inches.

Permeability is moderate to a depth of about 20 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for irrigated and nonirrigated crops, hay, and pasture and as rangeland. The main crops are wheat, barley, alfalfa, and grass. Oats is also suited to irrigated areas.

Cropland management. If this unit is used for cultivated crops, it is limited by the low available water capacity, cobbles on the surface, medium runoff, and the hazard of water erosion. The hazard of soil blowing is also a limitation in nonirrigated areas. Leaving crop residue on or near the surface conserves moisture, increases the water intake rate, improves tilth, and helps to control erosion. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion. Rock fragments in the surface layer cause rapid wear of tillage equipment. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the soil in this unit is droughty, light and frequent applications of irrigation water are needed.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced

grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. The unit is suited to mechanical practices such as pitting, scalping, furrowing, and chiseling to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. The main limitation for homesite development on this unit is the rapid permeability of the very gravelly loamy sand substratum. If the soil in this unit is used for septic tank absorption fields, the limitation of rapid permeability in areas where the substratum is at a depth of less than 25 inches can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass IIIe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

13—Attewan very stony loam, cool, 2 to 8 percent slopes. This deep, well drained soil is on fans in the Indian Creek area, south of Cameron. It formed in mixed alluvium. Slope is 2 to 8 percent. Elevation is 4,500 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of extremely stony and bouldery soils, soils that have gravelly and sandy material at a depth of less than 20 inches, and deep, nonstony soils. The extremely stony and bouldery areas are mainly long, narrow bands or stringers scattered throughout the unit. The soils that are shallow to gravelly and sandy material generally are in high-lying areas and in some drainageways. The deep, nonstony soils are on foot slopes of terrace edges. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Attewan soil is dark grayish brown very stony loam about 5 inches thick. The subsoil is brown gravelly clay loam about 4 inches thick. The upper 11 inches of the substratum is pale brown gravelly loam, and the lower part to a depth of 60 inches or more is pale brown very gravelly loamy sand and sand. Gravelly and sandy material is at a depth of 20 to 40 inches.

Permeability is moderate to a depth of about 20 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This unit is used as rangeland. It is not suited to cultivated crops because of the stones in the surface layer.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, fringed sagewort, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

This unit is not suited to mechanical treatment because of the stones in the surface layer.

Windbreak management. This unit is very poorly suited to windbreaks because of the high content of stones in the surface layer and droughtiness.

Homesite development. The main limitations for homesite development on this unit are the high content of stones in the surface layer and rapid permeability of the very gravelly loamy sand and sand substratum. If the soil in this unit is used for septic tank absorption fields, the limitation of rapid permeability in areas where the substratum is at a depth of less than 25 inches can be overcome by increasing the size of the absorption field. Stoniness makes excavation, leveling, and road construction difficult.

This map unit is in capability subclass VIIs, nonirrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

14—Badland. This map unit consists of clayey shale on uplands that have been deeply dissected and severely eroded by streams. The unit is steep, rough, and broken and has rounded ridges. It is in the northwestern part of the survey area. Slope is 8 to 45

percent. Elevation is 5,000 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Runoff is very rapid. Much of the area is barren or nearly barren. The vegetated areas are in narrow drainageways and small pockets and on shelves and nearly level remnants of older, eroding material.

The clayey texture of areas of this unit and the high hazard of erosion restrict the use and management of this unit to wildlife habitat and watershed.

This map unit is in capability class VIII, nonirrigated.

15—Bearmouth gravelly loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the southeastern part of the survey area, primarily in the Missouri Flats area. It formed in gravelly alluvium. Slope is 2 to 8 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Maxville soils scattered throughout the unit and soils that have a thick, dark-colored surface layer and are in low spots and small drainageways. Also included are small areas of Bearmouth soils that have a stony or cobbly surface layer and are mainly on terrace edges and on side slopes of drainageways. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Bearmouth soil is dark grayish brown gravelly loam 7 inches thick. The subsoil is brown very gravelly loam 8 inches thick. The substratum to a depth of 60 inches or more is brown extremely gravelly loamy sand. Gravelly and sandy material is at a depth of 10 to 20 inches.

Permeability is moderate to a depth of about 15 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. It is poorly suited to cultivated crops because of droughtiness and the short growing season.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, needleandthread, Idaho fescue, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of Idaho fescue, big sagebrush, skunkbush sumac, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, timothy, and wyethia may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is very poorly suited to nonirrigated windbreaks. The main limitation is droughtiness.

Homesite development. The main limitation for homesite development on this unit is the rapid permeability of the very gravelly loamy sand substratum. Because of this limitation, effluent from septic tank absorption fields may contaminate ground water. Cutbanks are not stable and are subject to slumping.

This map unit is in capability subclass VIs, nonirrigated. It is in Shallow to Gravel range site, 15- to 19-inch precipitation zone.

16—Bearmouth extremely stony loam, 0 to 4 percent slopes. This deep, well drained soil is on fans and terraces. It is in the southeastern part of the survey area, primarily in the Missouri Flats area. It formed in gravelly and stony alluvium. Slope is 0 to 4 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Maxville soils and soils that have a thick, dark-colored surface layer and are in low spots and small drainageways and on foot slopes of terrace edges. Also included are small areas of Bearmouth soils that have a very stony or bouldery surface layer. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Bearmouth soil is dark grayish brown extremely stony loam about 6 inches thick. The upper 6 inches of the subsoil is brown very stony loam, and the lower 8 inches is brown very stony sandy loam. The substratum to a depth of 60 inches or more is extremely gravelly loamy sand. Gravelly and sandy material is at a depth of 10 to 20 inches.

Permeability is moderate to a depth of about 20 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation,

the average annual wetting depth is about 24 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

This unit is used mainly as rangeland. It is not suited to cultivated crops because of the high content of stones, the short growing season, and droughtiness.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, needleandthread, Idaho fescue, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of Idaho fescue, big sagebrush, skunkbush sumac, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, timothy, and wyethia may invade. The potential native plant community produces about 1,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Use of mechanical treatment practices is not practical because of the extremely stony surface layer.

Windbreak management. This unit is very poorly suited to nonirrigated windbreaks. It is limited mainly by droughtiness and the extremely stony surface layer.

Homesite development. This unit is suited to homesite development. It is limited mainly by the rapid permeability of the substratum and the high content of stones. Because of the rapidly permeable substratum, effluent from septic tank absorption fields may contaminate ground water. Stoniness makes excavation, leveling, and road construction difficult. Cutbanks are not stable and are subject to slumping

This map unit is in capability subclass VIIs, nonirrigated. It is in Shallow to Gravel range site, stony, 15- to 19-inch precipitation zone.

17—Beaverell cobbly loam, cool, 0 to 6 percent slopes. This deep, well drained soil is on fans and terraces in Madison Valley and west of Melrose. The soil formed in very gravelly and cobbly alluvium. Slope is 0 to 6 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Trimad and Rivra soils. Also included are small areas of soils that have a stony surface layer. The areas of Rivra soils are adjacent to intermittent streams and are subject to flooding. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Beaverell soil is brown cobbly loam about 4 inches thick. The upper 7 inches of the subsoil is brown very gravelly clay loam, and the lower 6 inches is yellowish brown very gravelly sandy loam. The substratum to a depth of 60 inches or more is very pale brown extremely gravelly loamy sand. In some areas the surface layer is gravelly loam.

Permeability is moderate to a depth of about 17 inches and very rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. It is also used for irrigated hay and pasture. The unit is poorly suited to nonirrigated crops because of droughtiness. It is suited to irrigated small grain.

Cropland management. If this unit is used for irrigated hay and pasture, it is limited by the very low available water capacity and cobbles in the surface layer. Sprinkler irrigation is the most suitable method of applying water. Because the soil in this unit is droughty, light and frequent applications of irrigation water are needed. Cobbles on the surface interfere with tillage, sprinkler irrigation, and harvesting, but they do not prevent the use of farm machinery.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, Indian ricegrass, needleandthread, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of western wheatgrass, needleandthread, Sandberg bluegrass, blue grama, prairie junegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, brome snakeweed, annual bromes, and plains pricklypear may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is very poorly suited to nonirrigated windbreaks. It is limited mainly by droughtiness. Under irrigation, suitable trees for planting are Russian olive, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, skunkbush sumac, and lilac.

Homesite development. This unit is suited to

homesite development. It is severely limited for septic tank absorption fields because of the very rapid permeability of the substratum. Because of this limitation, effluent from septic tank absorption fields may contaminate ground water. Cutbanks are not stable and are subject to slumping.

This map unit is in capability subclasses VIs, nonirrigated, and IVs, irrigated. It is in Shallow to Gravel range site, 10- to 14-inch precipitation zone.

18—Blackhall-Rock outcrop complex, 15 to 45 percent slopes. This map unit is on hillsides and ridgetops in the northern and western parts of the survey area. Slope is 15 to 45 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 65 percent Blackhall sandy loam and 20 percent Rock outcrop. The Blackhall soil is on hillsides, and the Rock outcrop is on ridgetops.

Included in this unit are small areas of moderately sloping, deep soils on foot slopes and on isolated remnants of alluvial terraces. Also included are areas of gently sloping Blackhall soils on terraces and small buttes. Some of these areas are as large as 100 acres. Included areas make up about 15 percent of the total acreage.

The Blackhall soil is shallow and well drained. It formed in residuum derived dominantly from weakly consolidated, loamy sedimentary beds consisting of interbedded siltstone and sandstone. Typically, the surface layer is light brownish gray sandy loam 2 inches thick. The underlying material is grayish brown sandy loam 14 inches thick over weakly consolidated, interbedded sandstone and siltstone. Weakly consolidated, loamy sedimentary beds are at a depth of 10 to 20 inches.

Permeability is moderately rapid. Available water capacity is about 2 inches. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 16 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

The Rock outcrop is exposures of weakly consolidated, loamy sedimentary beds consisting of interbedded sandstone and siltstone.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of slope, shallow depth of the Blackhall soil, and the areas of Rock outcrop.

Rangeland management. The potential native plant community on the Blackhall soil is mainly bluebunch wheatgrass, needleandthread, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, Sandberg bluegrass, blue grama, threadleaf sedge, and skunkbush sumac increases. If overgrazing continues, plants such as annual bromes, rubber rabbitbrush, and broom snakeweed may invade. The potential native plant community produces about 1,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 600 pounds in years of below-normal precipitation.

Use of mechanical treatment practices is not practical because of the areas of Rock outcrop and steepness of slope. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited by steepness of slope and droughtiness.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope and the shallow depth to weakly consolidated, loamy sedimentary beds.

This map unit is in capability subclass VIIe, nonirrigated. It is in Shallow range site, 10- to 14-inch precipitation zone.

19—Blaine stony loam, 2 to 15 percent slopes. This moderately deep, well drained soil is on upland hills and ridges in the southern part of the survey area. It formed in material derived dominantly from igneous rock. Slope is 2 to 15 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Adel and Leavitt soils. These deep soils are at the base of slopes and in small depressional areas. Also included are small areas of randomly distributed escarpments and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Blaine soil is brown stony loam about 6 inches thick. The upper part of the subsoil is dark yellowish brown very stony clay loam about 4 inches thick, and the lower part is yellowish brown very stony loam about 9 inches thick. The substratum is very pale brown extremely stony loam 6 inches thick over fractured igneous bedrock. Fractured igneous bedrock is at a depth of 20 to 40

inches. The surface layer is loam in some areas on benches in the southeastern part of the survey area.

Permeability is moderate. Available water capacity is about 2 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 25 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is poorly suited to cultivated crops because of the short growing season, large stones in the surface layer, and very low available water capacity.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. This unit is suited to mechanical practices such as scarification and reseeding to improve areas of deteriorated rangeland.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by droughtiness.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by the depth to bedrock and stones in the soil. The soil is severely limited for septic tank filter fields because of the depth to bedrock. Fractures in the bedrock at a depth of 20 to 40 inches allow effluent to percolate through the bedrock to ground water supplies. Increasing the size of the absorption area may reduce such percolation. The deep cuts needed to provide essentially level building sites can expose bedrock. Stoniness makes excavation, leveling, and road construction difficult.

Recreational development. Stones on the surface limit use of this unit for recreational development.

This map unit is in capability subclass VIs, nonirrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

20—Borohemists, nearly level. This map unit consists of deep, very poorly drained, organic soils on bottoms in the western part of the survey area, around Sheridan and Twin Bridges. It formed in plant residue overlying alluvium. Slope is 0 to 1 percent. Elevation is 4,200 to 5,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

These soils are highly variable in the amount of fibre content and depth to mineral soil material. The upper part of these soils is mainly hemic soil material. Texture of the underlying mineral soil material ranges from silty clay loam to sand and gravel. Depth to the mineral soil material is 17 to 50 inches. The seasonal high water table is 12 inches above the surface to a depth of 12 inches below the surface. Standing water is on parts of this unit some time during the year.

Included in this unit is about 15 percent soils that have a shorter frost-free period and receive more precipitation than these Borohemists.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of the seasonal high water table.

Rangeland management. The potential native plant community is mainly tall reedgrasses, tall sedges, American sloughgrass, brookgrass, water parsnip, willows, bogorchid, bog birch, and dogwood. If the rangeland is overgrazed, the proportion of tall reedgrasses, American sloughgrass, and brookgrass decreases and the proportion of sedges, water parsnip, bogorchid, bog birch, and dogwood increases. If overgrazing continues, plants such as Kentucky bluegrass, shrubby cinquefoil, Rocky Mountain iris, and annual forbs may invade. The potential native plant community produces 5,000 to 6,500 pounds of air-dry vegetation per acre per year.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by wetness.

This map unit is in capability subclass Vw. It is in Wet Meadow range site, 10- to 14-inch precipitation zone.

21—Branham coarse sandy loam, 2 to 8 percent slopes. This moderately deep, well drained soil is on hills, mainly in the northern and western parts of the survey area. It formed in residuum derived dominantly from granite and granitic gneiss. Slope is 2 to 8 percent. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Rock outcrop, soils that are shallow to bedrock, and soils that are deep. The areas of Rock outcrop and shallow soils are

mainly on hilltops. The deep soils are in drainageways and at the base of slopes. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer is grayish brown and brown coarse sandy loam 4 inches thick. The subsoil is dark brown gravelly coarse sandy loam about 18 inches thick. The substratum is very pale brown and white gravelly coarse sand 8 inches thick. Granite is at a depth of 30 inches. Depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of 22 inches and moderately rapid below this depth. Available water capacity is about 2 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. The soil is droughty because of the texture and the very low available water capacity.

This unit is used as rangeland. A few areas are used for irrigated pasture and hay and for nonirrigated pasture.

Cropland management. This unit is poorly suited to nonirrigated crops. It is suited to irrigated pasture and hay. It is limited mainly by the short growing season and the very low available water capacity. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope where practical reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, Columbia needlegrass, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Columbia needlegrass decreases and the proportion of Idaho fescue, big sagebrush, lupine, hairy goldenaster, thickspike wheatgrass, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. This unit is suited to mechanical practices such as scalping, pitting, furrowing, and chiseling to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to nonirrigated windbreaks. It is limited mainly by droughtiness. Under irrigation, suitable trees for planting are Russian olive, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, skunkbush sumac, and lilac.

Homesite development. The main limitation for homesite development on this unit is the moderate depth to bedrock. Fractures in the bedrock at a depth of 20 to 40 inches allow effluent to percolate through the bedrock to ground water supplies. Increasing the size of the absorption area may reduce percolation.

This map unit is in capability subclasses VIs, nonirrigated, and VIe, irrigated. It is in Shallow to Gravel range site, 15- to 19-inch precipitation zone.

22—Branham-Rock outcrop complex, 8 to 45 percent slopes. This map unit is on hills west and south of Norris. It formed in granite. Slope is 8 to 45 percent. Elevation is 5,500 to 7,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 70 percent Branham coarse sandy loam and 15 percent Rock outcrop. The areas of Rock outcrop are on steep, south-facing slopes.

Included in this unit is 10 percent small areas of shallow gravelly sandy loam underlain by granitic rock. They are on narrow ridgetops and south-facing slopes. Also included are small areas of dark-colored soils in densely vegetated drainageways. Included areas make up about 15 percent of the total acreage.

The Branham soil is moderately deep and well drained. It formed in residuum and colluvium derived from granite. Typically, the surface layer is grayish brown and brown coarse sandy loam 4 inches thick. The subsoil is dark brown gravelly coarse sandy loam about 18 inches thick. The substratum is very pale brown and white gravelly coarse sand 8 inches thick. Granite is at a depth of 30 inches. Depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 22 inches and moderately rapid below this depth. Available water capacity is about 2 inches. Effective rooting depth

is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. The soil is droughty because of the texture and the very low available water capacity.

Rock outcrop is exposures of hard granite.

This unit is used as rangeland. It is not suited to cultivated crops because of the short growing season, steepness of slope, droughtiness, moderate depth to bedrock in the Branham soil, and areas of Rock outcrop.

Rangeland management. The potential native plant community on the Branham soil is mainly bluebunch wheatgrass, Idaho fescue, Columbia needlegrass, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Columbia needlegrass decreases and the proportion of Idaho fescue, big sagebrush, lupine, hairy goldenaster, thickspike wheatgrass, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. This soil is not suited to mechanical treatment because of the steepness of slope and areas of Rock outcrop. The surface layer of the soil is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks because of the steepness of slope and droughtiness.

Homesite development. This unit is poorly suited to homesite development because of slope and the moderate depth to bedrock. Most urban development is severely limited in the steeper areas. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Fractures in the bedrock at a depth of 20 to 40 inches allow effluent to percolate through the bedrock to ground water supplies. Increasing the size of the absorption area may reduce percolation.

This map unit is in capability subclass VIIe. The Branham soil is in Shallow to Gravel range site, 15- to 19-inch precipitation zone.

23—Bridger clay loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and foot slopes in the southwestern part of the survey area. It formed in alluvium. Slope is 2 to 8 percent. Elevation is 6,500 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small, randomly distributed areas of Adel and Leavitt soils and Bridger soils that have a loam surface layer. Included areas make up about 20 percent of the total acreage.

Typically, the surface layer of this Bridger soil, where mixed to a depth of 7 inches, is grayish brown clay loam. The upper 10 inches of the subsoil is light yellowish brown clay, and the lower 4 inches is light yellowish brown gravelly clay loam. The substratum to a depth of 60 inches or more is very pale brown very gravelly sandy clay loam.

Permeability is moderately slow to a depth of 21 inches and moderate below this depth. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland.

Cropland management. This unit is suited to irrigated and nonirrigated hay and pasture. It is limited mainly by the short growing season. It is also limited by the hazards of water erosion and soil blowing. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. It is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, western wheatgrass, shrubby cinquefoil, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, western wheatgrass, mountain big sagebrush, shrubby cinquefoil, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and rabbitbrush may invade. The potential native plant community produces about 2,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,400 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. The main limitations for homesite development on this unit are the restricted permeability, low soil strength, the potential for shrinking and swelling, and potential frost action. If the soil in this unit is used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field. The possibility of foundation failure because of low soil strength can be minimized by designing oversized footings and preparing a strong load-supporting base. Shrinking and swelling, frost action, and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Clayey range site, 15- to 19-inch precipitation zone.

24—Bridger cobbly clay loam, 8 to 35 percent slopes. This deep, well drained soil is on terraces, moraines, and foot slopes in the southwestern part of the survey area and on glacial moraines and dissected terraces in the northeastern part. It formed in alluvium and glacial till. Slope is 8 to 35 percent. Elevation is 5,500 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Adel and Tiban soils in the southwestern part of the survey area. Also included are small areas of Gaylord and Burnette soils in the northeastern part. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer, where mixed to a depth of 7 inches, is mainly grayish brown cobbly clay loam. The upper 10 inches of the subsoil is light yellowish brown clay, and the lower 4 inches is light yellowish brown gravelly clay loam. The substratum to a depth of 60 inches or more is very pale brown very gravelly sandy clay loam.

Permeability is moderately slow. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of the steepness of slope and a short growing season.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, western wheatgrass, shrubby cinquefoil, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, western wheatgrass, mountain big sagebrush, shrubby cinquefoil, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and rabbitbrush may invade. The potential native plant community produces about 2,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,400 pounds in years of below-normal precipitation.

This unit is suited to mechanical practices such as reseeding and scarifing to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. The main limitations of this unit for homesite development are slope, restricted permeability, low soil strength, shrink-swell potential, and potential frost action. If the soil in this unit is used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Effluent from absorption fields can surface in downslope areas and create a hazard to health. The possibility of foundation failure because of low soil strength can be minimized by designing oversized footings and preparing a strong load-supporting base. Shrinking and swelling, frost action, and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these

limitations. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIe, nonirrigated. It is in Clayey range site, 15- to 19-inch precipitation zone.

25—Bridger-Cryaquolls complex, 2 to 25 percent slopes. This map unit is on terraces, glacial moraines, and foot slopes in the southwestern part of the survey area. Slope is mainly 8 to 25 percent but ranges from 2 to 25 percent. Elevation is 6,500 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 70 percent Bridger cobbly clay loam and 20 percent Cryaquolls. The Bridger soil is on hillsides, terraces, and ridges, and the gently sloping to moderately sloping Cryaquolls are in drainageways and basins.

Included in this unit are small, randomly distributed areas of Adel and Leavitt soils. Included areas make up about 10 percent of the total acreage.

The Bridger soil is deep and well drained. It formed in alluvium and glacial till. Typically, the surface layer, where mixed to a depth of 7 inches, is grayish brown cobbly clay loam. The subsoil is mainly light yellowish brown clay about 14 inches thick. The substratum to a depth of 60 inches or more is very pale brown very gravelly sandy clay loam.

Permeability is moderately slow. Available water capacity is about 7 inches. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Cryaquolls are deep and poorly drained. They formed in colluvium, alluvium, and glacial till. These soils commonly have a dark-colored loam or clay loam surface layer and a gray or greenish gray loam, clay loam, or clay substratum.

Permeability is moderate to slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where these soils are under native vegetation, the average annual wetting depth is more than 60 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. A seasonal high water table is at a depth of 5 to 20 inches from late in spring to late in summer.

The soils in this unit are used as rangeland. They are very poorly suited to cultivated crops because of steepness of slope and a short growing season.

Rangeland management. The potential native plant community on the Bridger soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, western wheatgrass, shrubby cinquefoil, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, western wheatgrass, shrubby cinquefoil, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and rabbitbrush may invade. The potential native plant community produces about 2,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,400 pounds in years of below-normal precipitation.

The potential native plant community on the Cryaquolls is mainly sedges, tall reedgrass, tufted hairgrass, mannagrass, willow, water birch, aspen, elephanthead, and marshmarigold. If the rangeland is overgrazed, the proportion of tall reedgrass, tufted hairgrass, and mannagrass decreases and the proportion of elephanthead, marshmarigold, and willow increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 7,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 6,000 pounds in years of below-normal precipitation.

The Bridger soil in this unit is suited to mechanical practices such as scarifing and reseeding to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope and the wetness of the Cryaquolls.

Homesite development. This unit is poorly suited to homesite development. Some areas of the unit are unstable and are moving downslope; therefore, onsite investigation of potential building sites is needed before starting construction.

This map unit is in capability subclass VIe, nonirrigated. The Bridger soil is in Clayey range site, 15- to 19-inch precipitation zone, and the Cryaquolls are in Wet Meadow range site, 20- to 24-inch precipitation zone.

26—Bridger-Tiban-Adel complex, 8 to 25 percent slopes. This map unit is on glacial moraines and alluvial terraces in the southwestern part of the survey area. Slope is 8 to 25 percent. Elevation is 6,500 to

8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 50 percent Bridger cobbly clay loam, 25 percent Tiban cobbly loam, and 15 percent Adel loam. The Bridger soil is on terraces, glacial moraines, and foot slopes; the Tiban soil is on ridges and steep side slopes; and the Adel soil is on foot slopes and in swales.

Included in this unit are small, randomly distributed areas of Leavitt soils, very poorly drained soils, soils that have slopes of less than 8 percent, and very poorly drained soils in depressional areas. Included areas make up about 10 percent of the total acreage.

The Bridger soil is deep and well drained. It formed in alluvium and glacial till. Typically, the surface layer, where mixed to a depth of 7 inches, is grayish brown cobbly clay loam. The subsoil is mainly light yellowish brown clay about 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown very gravelly sandy clay loam.

Permeability is moderately slow. Available water capacity is about 7 inches. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Tiban soil is deep and well drained. It formed in alluvium. Typically, the surface layer is brown cobbly loam about 8 inches thick. The subsoil is grayish brown cobbly loam about 6 inches thick. The substratum to a depth of 60 inches or more is pale brown and very pale brown very cobbly loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Adel soil is deep and well drained. It formed in alluvial and eolian material. Typically, the surface layer is very dark grayish brown loam about 37 inches thick. The subsoil to a depth of 60 inches or more is grayish brown and brown loam.

Permeability is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is more than 60 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are very poorly suited to cultivated crops because of the short, steep slopes and a short growing season.

Rangeland management. The potential native plant community on the Bridger soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, western wheatgrass, shrubby cinquefoil, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, western wheatgrass, mountain big sagebrush, shrubby cinquefoil, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and rabbitbrush may invade. The potential native plant community produces about 2,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,400 pounds in years of below-normal precipitation.

The potential native plant community on the Tiban soil is mainly bluebunch wheatgrass, Idaho fescue, mountain big sagebrush, and rough fescue. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential native plant community on the Adel soil is mainly basin wildrye, Richardson needlegrass, mountain brome, Idaho fescue, mountain big sagebrush, bluebunch wheatgrass, and rough fescue. If the rangeland is overgrazed, the proportion of basin wildrye, Richardson needlegrass, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and other perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

The soils in this unit are suited to mechanical practices such as scarifing and reseeding to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope.

Homesite development. The soils in this unit are poorly suited to homesite development. Some areas of the unit are unstable and are moving downslope; therefore, onsite investigation of potential building sites is needed before starting construction.

This map unit is in capability subclass VIe, nonirrigated. The Bridger soil is in Clayey range site, 15- to 19-inch precipitation zone; the Tiban soil is in Silty range site, 15- to 19-inch precipitation zone; and the Adel soil is in Silty range site, dry, 20- to 24-inch precipitation zone.

27—Brocko silt loam, cool, 0 to 2 percent slopes. This deep, well drained soil is on terraces in the northeastern part of the survey area. It formed in alluvial and eolian material. Slope is 0 to 2 percent. Elevation is 4,300 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of soils that have a dark-colored, noncalcareous surface layer. Also included are small areas of soils that have slopes of more than 2 percent. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Brocko soil is brown silt loam about 8 inches thick. The upper 9 inches of the underlying material is light gray silt loam, and the lower part to a depth of 60 inches or more is light gray and very pale brown very fine sandy loam.

Permeability is moderate. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The soil is calcareous throughout.

Most areas of this unit are used as cropland. A few areas are used as rangeland and for nonirrigated grass for pasture. The main irrigated crops are small grain, alfalfa, and grasses and legumes for hay and pasture. The main nonirrigated crop is small grain.

Cropland management. This unit is well suited to cultivated crops. It is limited mainly by the hazard of soil blowing. Furrow, corrugation, and sprinkler irrigation systems are suited to this unit. Border irrigation is also suited to the unit, but most areas need to be leveled for efficient application of water. The surface layer of the soil is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and increases fertility. Suitable methods for reducing soil blowing are stripcropping, using tall grass barriers and field windbreaks, minimum tillage, and stubble mulch tillage. Growing grasses and legumes for hay and pasture also reduces soil blowing.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by moderate permeability and potential frost action. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Frost action can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. In places, excavation for roads can expose material that is highly susceptible to soil blowing.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

28—Brocko silt loam, cool, 2 to 12 percent slopes. This deep, well drained soil is on fans and terraces in

the northern part of the survey area. It formed in alluvial and eolian material. Slope is 2 to 12 percent. Elevation is 4,300 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Crago, Nuley, and Varney soils. The droughty Crago soils are on terrace edges and have slopes of more than 8 percent. The Nuley and Varney soils are randomly distributed throughout the unit. Also included are small areas of soils that have a cobbly surface. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Brocko soil is brown silt loam about 8 inches thick. The upper 9 inches of the underlying material is light gray silt loam, and the lower part to a depth of 60 inches or more is light gray and very pale brown very fine sandy loam.

Permeability is moderate. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. The soil is calcareous throughout.

Most areas of this unit are used as cropland. A few areas are used as rangeland and for irrigated grass for pasture. The main irrigated crops are small grain, alfalfa, and grass and legumes for hay and pasture. The main nonirrigated crop is small grain.

Cropland management. This unit is well suited to cultivated crops. It is limited mainly by the hazards of soil blowing and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is suited to this unit. The surface layer is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheat-grass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on the soil in this unit if the rangeland vegetation is in poor condition. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by the moderate permeability and potential frost action. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Frost action can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. In places, excavation for roads can expose material that is highly susceptible to soil blowing.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

29—Brocko-Crago complex, cool, 8 to 45 percent slopes. This map unit is on terrace escarpments in the Madison and Ruby Valleys. Slope is 8 to 45 percent. Elevation is 4,300 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 60 percent Brocko silt loam and 30

percent Crago gravelly loam. The Brocko soil is mainly on the upper parts of slopes and on foot slopes, and the Crago soil is mainly on the lower parts of slopes and on terrace edges.

Included in this unit are small areas of Scravo and Varney soils and recent alluvium. The steep Scravo soils are on terrace edges. The Varney soils are at the base of slopes. The areas of recent alluvium, some of which are poorly drained, are in narrow drainageways that dissect terraces. Included areas make up 10 percent of the total acreage.

The Brocko soil is deep and well drained. It formed in alluvial and eolian material. Typically, the surface layer is light brownish gray silt loam about 4 inches thick. The upper 8 inches of the underlying material is light gray silt loam, and the lower part to a depth of 60 inches or more is light gray and very pale brown very fine sandy loam.

Permeability is moderate. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. The soil is calcareous throughout.

The Crago soil is deep and well drained. It formed in calcareous gravelly alluvium derived dominantly from limestone. Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The upper 10 inches of the underlying material is light brownish gray gravelly loam, and the lower part to a depth of 60 inches or more is light gray very gravelly sandy loam.

Permeability is moderate to a depth of about 14 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. The soil is calcareous throughout.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of slope.

Rangeland management. The potential native plant community on the Brocko soil is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The potential native plant community on the Crago soil is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

This unit is suited to mechanical treatment practices such as scarifing and reseeding to improve areas of deteriorated rangeland. The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is not suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. The main limitations for homesite development on this unit are slope, the moderate permeability, and potential frost action. If the soils in this unit are used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. The steeper areas are poorly suited to homesite development. Frost action can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation. In places, excavation for roads can expose material that is highly susceptible to soil blowing.

This map unit is in capability subclass VIe, nonirrigated. The Brocko soil is in Silty range site, 10- to 14-inch precipitation zone, and the Crago soil is in Silty range site, limy, 10- to 14-inch precipitation zone.

30—Brocko Variant silt loam, 2 to 12 percent slopes. This deep, well drained soil is on foot slopes and terraces in the northeastern part of the survey area. It formed in Tertiary lake sediment. Slope is 2 to 12 percent. Elevation is 4,500 to 5,200 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 40 degrees F, and the

average frost-free period is about 100 days.

Included in this unit are small areas of Amsterdam soils and soils that have a thick, dark-colored surface layer. These soils are in the less sloping areas of the unit. Also included are small areas of gravelly soils along drainageways and on knolls. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Brocko Variant soil is light brownish gray silt loam about 5 inches thick. The upper 18 inches of the underlying material is mainly light gray silty clay loam, and the lower part to a depth of 60 inches or more is white silt loam.

Permeability is moderate. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used mainly as nonirrigated cropland. It is also used as rangeland. The main crop is small grain. The unit is also suited to irrigated and nonirrigated hay and pasture and irrigated small grain.

Cropland management. This unit is well suited to cultivated crops. It is limited mainly by runoff and the hazards of soil blowing and water erosion. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Suitable practices for reducing soil blowing, water erosion, and runoff are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; stubble mulch tillage; and growing grasses and legumes for hay and pasture. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by the moderate permeability, low soil strength, and potential frost action. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Frost action and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

31—Bullrey loam, bedrock substratum, 2 to 12 percent slopes. This deep, well drained soil is on upland benches in the southeastern part of the survey area. It formed in residuum derived from welded tuff and has a mantle of eolian material. Slope is 2 to 12 percent. Elevation is 6,400 to 7,400 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Adel, Sebud, and Tiban soils and Rock outcrop. The Adel soils are on the bottom of drainageways. The Sebud and Tiban soils are on steep side slopes where alluvium has been mixed with the welded tuff. The Rock outcrop is on ridgetops and escarpments. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Bullrey soil is dark grayish brown loam about 21 inches thick. The subsoil is light yellowish brown gravelly loam about 18 inches thick. The substratum is pale brown very gravelly fine sandy loam about 9 inches thick over fractured,

semiconsolidated welded tuff. Welded tuff is at a depth of 40 to 60 inches.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 40 to 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 60 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. It is also used for grass pasture and irrigated grass-legume hay. The unit is poorly suited to cultivated crops. It is limited mainly by the short growing season.

Cropland management. This unit is suited to irrigated and nonirrigated hay and pasture. It is limited mainly by the short growing season. It is also limited by the hazard of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community on this unit is mainly spike fescue, rough fescue, basin wildrye, Columbia needlegrass, mountain brome, Richardson needlegrass, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of spike fescue, rough fescue, basin wildrye, Columbia needlegrass, mountain brome, and Richardson needlegrass decreases and the proportion of Idaho fescue, timber danthonia, Canby bluegrass, lupine, and mountain big sagebrush increases. If overgrazing continues, plants such as Canada bluegrass, Kentucky bluegrass, timothy, onespike danthonia, and annual forbs may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. In places, brush control improves production of desirable forage plants. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. The main limitations for homesite development on this unit are the depth to bedrock, low soil strength, potential frost action, and slope. Increasing the size of septic tank absorption fields helps to compensate for the restricted depth to welded tuff. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Frost action and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, 20- to 24-inch precipitation zone.

32—Comad-Earcree complex, 8 to 45 percent slopes. This map unit is on mountainsides and moraines. Slope is 8 to 45 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

This unit is about 60 percent Comad very stony loamy sand and 25 percent Earcree gravelly sandy loam. The Comad soil is on ridges and side slopes, and the Earcree soil is on strongly sloping to moderately steep fans and in depressional areas.

Included in this unit are small areas of Shadow soils and Rock outcrop. The Shadow soils are on foot slopes and in areas where the underlying material is loamy. The Rock outcrop is on ridgetops. Included areas make up about 15 percent of the total acreage.

The Comad soil is deep and excessively drained. It formed in alluvium, colluvium, and glacial till derived from granite, gneiss, and schist. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is dark brown very stony loamy sand about 3 inches thick. The upper part of the subsurface layer is pale brown very stony loamy sand about 14 inches thick, and the lower part is dominantly very pale brown very stony loamy sand about 25 inches thick. It has thin layers of light

yellowish brown sandy clay loam. The substratum to a depth of 66 inches or more is light yellowish brown very stony loamy sand.

Permeability is rapid. Available water capacity is about 3 inches. Effective rooting depth is 66 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 66 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

The Earcree soil is deep and well drained. It formed in alluvium and colluvium derived from gneiss, schist, sandstone, and granite. Typically, the surface layer is dark grayish brown and grayish brown gravelly sandy loam about 18 inches thick. The subsoil is pale brown gravelly coarse sandy loam about 3 inches thick. The upper part of the substratum is light brownish gray gravelly coarse sandy loam about 28 inches thick, and the lower part to a depth of 63 inches or more is pale brown very gravelly loamy coarse sand.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 63 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 63 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The soils in this unit are used as woodland and grazeable understory.

Rangeland management. The potential native understory on the Comad soil is mainly mallow ninebark, common snowberry, pinegrass, and white spirea. The understory provides a limited amount of forage. It produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 300 pounds in years of below-normal precipitation.

The potential native plant community on the Earcree soil is mainly mountain brome, Richardson needlegrass, basin wildrye, Columbia needlegrass, bearded wheatgrass, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, Columbia needlegrass, and bearded wheatgrass decreases and the proportion of Idaho fescue, mountain big sagebrush, and forbs increases. If overgrazing continues, plants such as onespike danthonia, timothy, Kentucky bluegrass, and annual bromes may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

Use of mechanical treatment practices is not practical because of stones in the surface layer, steepness of slope, and the included areas of Rock outcrop.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope and stones on the surface of the Comad soil.

Forest management. The Comad soil is suited to Douglas fir and lodgepole pine. The site index is 41 for Douglas fir and 68 for lodgepole pine. The potential annual production (CMAI) per acre is about 50 cubic feet or 160 board feet (Scribner rule) for Douglas fir and 72 cubic feet or 210 board feet for lodgepole pine. Potential production is estimated for an even-aged, fully stocked stand of trees.

The main limitations for timber management are slope, stones in the surface layer, and low available water capacity. Steepness of slope and stones in the surface layer limit the kinds of equipment that can be used. Understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard if the soil is disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. If the soils in this unit are used for roads, they are limited mainly by slope and stones in the surface layer. Stoniness makes excavation, leveling, and road construction difficult. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. The main limitation for homesite development on this unit is slope. The Comad soil is also limited by rapid permeability. Because the Comad soil is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIIs, nonirrigated. The Comad soil is in woodland suitability group 4X. The Earcree soil is in Sandy range site, 20- to 24-inch precipitation zone.

33—Crago gravelly loam, cool, 0 to 8 percent slopes. This deep, well drained soil is on fans and terraces in Madison and Ruby Valleys. It formed in gravelly alluvium derived dominantly from limestone. Slope is 0 to 8 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of randomly

distributed Amesha, Kalsted, Musselshell, and Scravo soils. Also included are small areas of soils that have a lime-cemented layer at a depth of 10 to 20 inches. These soils are on the Ruby Creek fan, and in some places they limit root development of deep-rooted plants. Also included are areas of soils that have a cobbly surface layer and are scattered throughout the unit. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Crago soil is light brownish gray gravelly loam about 4 inches thick. The upper 10 inches of the underlying material is light gray gravelly loam, the next 18 inches is white very gravelly sandy loam, and the lower part to a depth of 60 inches or more is light brownish gray extremely gravelly loamy sand. In some areas in Ruby Valley the surface layer is loam.

Permeability is moderate to a depth of about 32 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout. It is droughty because of the high content of coarse fragments and the loamy sand texture of the lower part of the soil.

This unit is used for irrigated crops and as rangeland. The main irrigated crops are alfalfa and grass for hay, grass for pasture, and small grain. The unit is poorly suited to nonirrigated crops. It is limited mainly by droughtiness.

Cropland management. If this unit is used for irrigated crops, it is limited by medium runoff and the hazards of soil blowing and water erosion. The surface layer is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. If the soil in this unit is cultivated, fall plowing should be avoided to minimize soil blowing. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the soil in this unit is droughty, light and frequent applications of irrigation water are needed. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion. Gravel in the surface layer causes rapid wear of tillage equipment.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is poorly suited to windbreaks. The high content of lime and droughtiness limit the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is severely limited for septic tank absorption fields because of the rapid permeability of the underlying material. Because of this limitation, effluent from septic tank absorption fields may contaminate ground water. Cutbanks are not stable and are subject to slumping.

This map unit is in capability subclasses VIs, nonirrigated, and IVe, irrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

34—Crago gravelly loam, cool, rolling. This deep, well drained soil is on fans and foot slopes in Ruby Valley. It formed in gravelly alluvium derived dominantly from limestone. Slope is 8 to 15 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Kalsted, Musselshell, and Scravo soils, soils that have a cobbly surface layer, and soils that have slopes of more than 15 percent. Included areas make up about 15 percent of the total area.

Typically, the surface layer of this Crago soil is light brownish gray gravelly loam about 4 inches thick. The upper 10 inches of the underlying material is light gray gravelly loam, and the lower part to a depth of 60 inches or more is white very gravelly sandy loam.

Permeability is moderate to a depth of about 14 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used mainly as rangeland. It is poorly suited to cultivated crops because of the short, broken slopes and the hazard of water erosion.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is poorly suited to windbreaks. The high content of lime and droughtiness limit the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by slope, moderate permeability, and the potential for slumping. Excavation for roads can expose material that is highly susceptible to water erosion. Making low-gradient cuts and fills and establishing a suitable plant cover reduce water erosion. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Cutbanks are not stable and are subject to slumping. Access roads must be designed to control surface runoff and help stabilize cuts.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

35—Crago very stony loam, cool, 2 to 45 percent slopes. This deep, well drained soil is on terrace edges, fans, and hills in Ruby Valley. It formed in cobbly and stony alluvium derived dominantly from limestone. Slope is 2 to 45 percent. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Amesha, Kalsted, Musselshell, and Scravo soils and soils that have a gravelly loam surface layer. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Crago soil is light brownish gray very stony loam about 4 inches thick. The upper 11 inches of the underlying material is pale brown very stony loam, and the lower part to a depth of 60 inches or more is light brownish gray very cobbly sandy loam.

Permeability is moderate to a depth of about 15 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight. This soil is calcareous throughout.

This unit is used as rangeland. It is not suited to cultivated crops because of slope and the very stony surface layer.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600

pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Use of mechanical treatment practices is not practical because of the steepness of slope and the very stony surface layer.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by the steepness of slope, droughtiness, and the very stony surface layer.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by slope, moderate permeability, and large stones throughout the soil. Excavation for roads can expose material that is highly susceptible to water erosion. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Making low-gradient cuts and fills and establishing a suitable plant cover reduce water erosion. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Stoniness makes excavation, leveling, and road construction difficult.

This map unit is in capability subclass VIIs, nonirrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

36—Crago, cool-Kalsted-Pensore complex, 8 to 45 percent slopes. This map unit is on dissected limestone hills in the northwestern part of the survey area. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 40 percent Crago very stony loam, 30 percent Kalsted gravelly sandy loam, and 25 percent Pensore very channery loam. The Crago soil is on side slopes, the Kalsted soil is on foot slopes and fans and in intermittent drainageways, and the Pensore soil is on ridges.

Included in this unit is about 5 percent Rock outcrop on ridgetops.

The Crago soil is deep and well drained. It formed in cobbly and stony alluvium and colluvium derived dominantly from limestone. Typically, the surface layer is light brownish gray very stony loam about 4 inches thick. The upper 11 inches of the underlying material is pale brown very stony loam, and the lower part to a depth of 60 inches or more is light gray very cobbly sandy loam.

Permeability is moderate to a depth of about 15 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight. This soil is calcareous throughout.

The Kalsted soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is gray gravelly sandy loam about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray gravelly sandy loam.

Permeability is moderately rapid. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

The Pensore soil is shallow and well drained. It formed in material derived from limestone. Typically, the surface layer is light brownish gray very channery loam about 4 inches thick. The underlying material to a depth of 16 inches is light gray very channery loam. Fractured limestone is at a depth of 16 inches. Depth to bedrock is 10 to 20 inches.

Permeability is moderate. Available water capacity is less than 2 inches. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used as rangeland. It is not suited to cultivated crops because of steepness of slope, the very stony surface layer of the Crago soil, and the very low available water capacity of the Pensore soil.

Rangeland management. The potential native plant community on the Crago soil is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant

community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The potential native plant community on the Kalsted soil is mainly bluebunch wheatgrass, needleandthread, prairie sandreed, Indian ricegrass, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, prairie sandreed, and Indian ricegrass decreases and the proportion of needleandthread, thickspike wheatgrass, threadleaf sedge, prairie junegrass, blue grama, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The potential native plant community on the Pensore soil is mainly bluebunch wheatgrass, needleandthread, antelope bitterbrush, and curlleaf mountainmahogany. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, Sandberg bluegrass, blue grama, threadleaf sedge, antelope bitterbrush, and curlleaf mountainmahogany increases. If overgrazing continues, plants such as annual bromes, rubber rabbitbrush, and broom snakeweed may invade. The potential native plant community produces about 1,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 600 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. The soils in this unit are limited for livestock watering ponds and other impoundments because of the potential for seepage. Reservoirs need to be lined to prevent excessive seepage. Mechanical treatment is not practical because of steepness of slope and the very stony surface layer of the Crago soil.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope and the very stony surface layer and droughtiness of the Crago soil.

Homesite development. The main limitations for homesite development on the Crago soil are slope and large stones. The Kalsted soil is limited mainly by slope. Excavation for roads can expose material that is highly susceptible to water erosion. Making low-gradient cuts and fills and establishing a suitable plant cover reduce water erosion. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Stoniness makes excavation, leveling, and road construction difficult. The Pensore unit is poorly suited to homesite development because of slope and the shallow depth to bedrock.

This map unit is in capability subclass VIIe, nonirrigated. The Crago soil is in Silty range site, limy, 10- to 14-inch precipitation zone; the Kalsted soil is in Sandy range site, 10- to 14-inch precipitation zone; and the Pensore soil is in Shallow range site, 10- to 14-inch precipitation zone.

37—Crago-Scravo complex, cool, 15 to 45 percent slopes. This map unit is on terrace breaks in Madison and Ruby Valleys. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 50 percent Crago very gravelly loam and 40 percent Scravo cobbly sandy loam. The Crago soil is on the lower part of slopes, and the Scravo soil is on the upper part of slopes.

Included in this unit are small, randomly distributed areas of soils that are 20 to 40 inches deep or more to gravelly and sandy material. Also included are small areas of calcareous conglomerate and sandstone outcrop and soils that have a stony surface layer. Included areas make up about 10 percent of the total acreage.

The Crago soil is deep and well drained. It formed in gravelly alluvium derived dominantly from limestone. Typically, the surface layer is grayish brown very gravelly loam about 4 inches thick. The upper 22 inches of the underlying material is light gray very gravelly loam, and the lower part to a depth of 60 inches or more is light gray very gravelly sandy loam.

Permeability is moderate to a depth of about 26 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout. It is droughty because of the high content of coarse fragments and the sandy loam texture of the lower part of the soil.

The Scravo soil is deep and well drained. It formed in gravelly and cobbly alluvium. Typically, the surface layer is grayish brown cobbly sandy loam 4 inches thick. The upper 10 inches of the substratum is light

gray very gravelly sandy loam, and the lower part to a depth of 60 inches or more is very gravelly loamy sand. Gravelly and sandy material is at a depth of 5 to 18 inches.

Permeability is moderately rapid to a depth of about 14 inches and rapid below this depth. Available water capacity is about 2 inches. Effective rooting depth is 5 to 18 inches. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is droughty because of the high content of coarse fragments and the sandy texture of the lower part of the soil.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of slope.

Rangeland management. The potential native plant community on the Crago soil is mainly bluebunch wheatgrass, needleandthread, and western wheatgrass. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, and threadleaf sedge increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The potential native plant community on the Scravo soil is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, Sandberg bluegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, pricklypear, and annual bromes may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Use of mechanical treatment is not practical because of the steepness of slope.

Windbreak management. The soils in this unit are very poorly suited to windbreaks because of the steepness of slope, droughtiness, and coarse fragments in the surface layer.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope. Because the underlying material of the Scravo soil is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water. Cutbanks are not stable and are subject to slumping.

This map unit is in capability subclass VIIe, nonirrigated. The Crago soil is in Silty range site, limy, 10- to 14-inch precipitation zone, and the Scravo soil is in Shallow to Gravel range site, 10- to 14-inch precipitation zone.

38—Cryaquolls, nearly level. This map unit consists of deep, poorly drained and very poorly drained soils on bottom lands along streams and drainageways and in swales around spring areas on foothills and mountains. These soils formed in alluvium. Slope is 0 to 4 percent. Elevation is more than 5,500 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

The soils in this unit are highly variable in texture, depth to gravel, and wetness. Texture is clay loam to loamy sand. Depth to gravel is 0 to 40 inches. Flooding is frequent to rare, and the seasonal high water table is at a depth of 6 to 30 inches.

This unit is used as rangeland.

Rangeland management. The potential native plant community is mainly sedges, tall reedgrass, tufted hairgrass, mannagrass, willows, water birch, aspen, elephanthead, and marshmarigold. If the rangeland is overgrazed, the proportion of tall reedgrass, tufted hairgrass, and mannagrass decreases and the proportion of elephanthead, marshmarigold, and willows increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. Small percentages of other plants on this unit include Engelmann spruce. The potential native plant community produces 6,000 to 7,000 pounds per acre of air-dry vegetation per year, depending on soil conditions.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by wetness and the hazard of flooding.

This map unit is in capability subclass Vw. It is in Wet Meadow range site, 20- to 24-inch precipitation zone.

39—Cryoborolls, strongly sloping. This map unit consists mainly of moderately deep, well drained soils on mountain ridges in the Madison Range, in the eastern part of the survey area. These soils formed in

residuum derived dominantly from limestone with some shale and sandstone. Slope is 4 to 15 percent. Elevation is 8,500 to 9,500 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 34 degrees F, and the average frost-free period is about 45 days. Frost may occur at any time in summer.

This unit is about 50 percent moderately deep soils, 20 percent deep soils, and 10 percent shallow soils.

Included in randomly distributed areas of this unit are about 5 percent Rock outcrop, 5 percent poorly drained soils, 5 percent soils that have short, steep slopes, and 5 percent moderately deep Cryochrepts.

The Cryoborolls are highly variable in texture and amount of soil development. They are mainly moderately deep, well drained soils. The surface layer is mainly very dark gray, black, or very dark brown loam or gravelly loam. The subsoil is very dark grayish brown, dark brown, or dark yellowish brown gravelly loam to clay. Below this, at a depth of 20 to 40 inches, is limestone.

Permeability is moderate. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly for recreation and as wildlife habitat. It is also used as rangeland.

Rangeland management. The potential native plant community is mainly spike fescue, alpine bluegrass, tufted hairgrass, sedges, lupine, alpine timothy, and cinquefoil. If the rangeland is overgrazed, the proportion of spike fescue, alpine bluegrass, tufted hairgrass, and alpine timothy decreases and the proportion of cinquefoil, sedges, and shrubby cinquefoil increases. If overgrazing continues, plants such as Kentucky bluegrass may invade. The potential native plant community produces about 3,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by moderate depth to bedrock.

This map unit is in capability subclass VIIe, nonirrigated. It is in Silty range site, cold, 20- to 24-inch precipitation zone.

40—Cryorthents, steep. This map unit is in the mountainous part of the survey area. Slope is 15 to 60 percent. The average annual precipitation is about 17 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit consists mainly of open pit areas and piles of mine tailings. Talc is the primary mineral mined in most areas. A few small gold mines are also in this unit.

Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This unit supports little vegetation. The piles of tailings are poor sites for establishing vegetation because of the steepness of slope, lack of organic matter, high reaction, and poor soil structure. Establishment of good plant cover is necessary to control water erosion and soil blowing on this unit. Special plants adapted to the site and intensive management of the site such as fertilization, incorporation of organic matter, and grading the piles of tailings are needed to establish vegetation on this unit.

This map unit is in capability subclass VIIIe.

41—Earcree sandy loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and foot slopes in Centennial Valley. It formed in eolian material. Elevation is 7,000 to 7,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Hapgood and Sebud soils, Rock outcrop, and sandy alluvium. The Hapgood and Sebud soils commonly have a cobbly or stony surface layer and are on foot slopes adjacent to the steeper, rolling uplands. The areas of Rock outcrop are scattered on the upper part of slopes. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Earcree soil is grayish brown sandy loam about 16 inches thick. The subsoil to a depth of 60 inches or more is pale brown sandy loam.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used as rangeland.

Cropland management. This unit is suited to irrigated and nonirrigated pasture and hay. It is limited mainly by the short growing season. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits

the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit. It is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly mountain brome, Richardson needlegrass, basin wildrye, Columbia needlegrass, bearded wheatgrass, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, Columbia needlegrass, and bearded wheatgrass decreases and the proportion of Idaho fescue, mountain big sagebrush, and forbs increases. If overgrazing continues, plants such as onespike danthonia, timothy, Kentucky bluegrass, and annual bromes may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. This unit is suited to mechanical practices such as scalping, pitting, chiseling, and furrowing to improve areas of deteriorated rangeland.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Sandy range site, 20- to 24-inch precipitation zone.

42—Earcree gravelly sandy loam, dry, 2 to 8 percent slopes. This deep, well drained soil is on fans and foot slopes in the southern part of the survey area. It formed in alluvium and colluvium derived dominantly from gneiss, schist, and granite. Slope is 2 to 8 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 85 days.

Included in this unit are small areas of Sebud soils and soils that have few coarse fragments in the surface layer. The Sebud soil is in high-lying areas and on steeper slopes adjacent to upland hills. The soils that have few coarse fragments in the surface layer are mainly in low-lying areas and on lower, less sloping edges of fans and foot slopes. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Earcree soil is grayish brown gravelly sandy loam about 16 inches thick. The subsoil to a depth of 60 inches or more is pale brown gravelly sandy loam.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used mainly as rangeland. It is also used for irrigated hay and pasture.

Cropland management. This unit is suited to irrigated and nonirrigated hay and pasture. It is limited mainly by the short growing season. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, basin wildrye, mountain brome, Richardson needlegrass, Columbia needlegrass, and Idaho fescue. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, basin wildrye, mountain brome, Richardson needlegrass, and Columbia needlegrass decreases and the proportion of Idaho fescue, big sagebrush, hairy goldenaster, thickspike wheatgrass, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

In places, brush control improves production of

desirable forage plants. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. This unit is suited to mechanical practices such as pitting, scalping, furrowing, and chiseling to improve areas of deteriorated rangeland.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Sandy range site, 15- to 19-inch precipitation zone.

43—Earcree gravelly sandy loam, slightly wet, 8 to 35 percent slopes. This deep, well drained soil is in drainageways in the northeastern part of the survey area. It formed in alluvium and colluvium derived dominantly from gneiss and schist. Slope is 8 to 35 percent. Elevation is 5,600 to 7,000 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Poin and Sebud soils on ridges. Also included are small areas of stony and cobbly soils and wet soils near the head of drainageways and along stream channels. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Earcree soil is gray gravelly sandy loam about 28 inches thick. The subsoil to a depth of 60 inches or more is pale brown gravelly sandy loam.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil receives additional moisture in spring and early in summer as a result of runoff from surrounding higher lying areas.

This unit is used mainly for grazeable understory production. Occasionally some of the overstory of quaking aspen is harvested.

Rangeland management. The potential native understory is mainly mountain brome, nodding brome, blue wildrye, sedges, bearded wheatgrass, northern bedstraw, heartleaf arnica, common snowberry, russet buffaloberry, saskatoon serviceberry, rose, and Oregongrape. The understory provides a moderate amount of forage. The potential native understory produces about 800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

Forest management. This unit is suited to quaking aspen. The site index for quaking aspen is 47. The potential annual production (CMAI) per acre is about 30 cubic feet.

The main limitations for timber management are low productivity of the quaking aspen stands and lack of markets for the tree species. Little use is made of quaking aspen at present. Occasionally it is cut for use as firewood or as framing for the manufacture of stuffed furniture.

Homesite development. The main limitation for homesite development on this unit is slope. The unit is severely limited for septic tank filter fields because of steepness of slope. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIe, nonirrigated. It is in woodland suitability group 2A.

44—Earcree, dry-Branham-Rock outcrop complex, 35 to 60 percent slopes. This map unit is on hills west and south of Norris. The soils formed in residuum and colluvium derived dominantly from granite. Elevation is 5,500 to 7,000 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 40 percent Earcree gravelly sandy loam, 20 percent Branham coarse sandy loam, and 20 percent Rock outcrop. The Earcree soil is on side slopes, the Branham soil is on steep, north-facing slopes, and the Rock outcrop is on steep and very steep slopes.

Included in this unit are small areas of Sebud, Rochester, and Poin soils. The deep Sebud soils have a cover of grass. The Rochester soils support mainly Douglas fir and limber pine. The Poin soil is on narrow ridges adjacent to areas of Rock outcrop. Included areas make up about 20 percent of the total acreage.

The Earcree soil is deep and well drained. It formed

in colluvium derived from granite. Typically, the surface layer is grayish brown gravelly sandy loam about 16 inches thick. The subsoil to a depth of 60 inches or more is pale brown gravelly sandy loam.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Branham soil is moderately deep and well drained. It formed in residuum derived from granite. Typically, the surface layer is grayish brown and brown coarse sandy loam about 4 inches thick. The upper 4 inches of the subsoil is dark brown coarse sandy loam, and the lower 14 inches is yellowish brown gravelly coarse sandy loam. The substratum is yellowish brown gravelly loamy coarse sand about 8 inches thick over hard granite. Granite is at a depth of 30 inches. Depth to bedrock is 20 to 40 inches.

Permeability is moderate to a depth of about 22 inches and moderately rapid below this depth. Available water capacity is about 2 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is droughty because of the texture and the very low available water capacity.

The Rock outcrop is mainly ledges, pillars, and rounded, boulderlike areas of granite.

This unit is used mainly as rangeland. It is not suited to cultivated crops because of the steepness of slope and the areas of Rock outcrop.

Rangeland management. The potential native plant community on the Earcree soil is mainly bluebunch wheatgrass, basin wildrye, mountain brome, Richardson needlegrass, Columbia needlegrass, and Idaho fescue. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, basin wildrye, mountain brome, Richardson needlegrass, and Columbia needlegrass decreases and the proportion of Idaho fescue, big sagebrush, hairy goldenaster, thickspike wheatgrass, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

The potential native plant community on the Branham soil is mainly bluebunch wheatgrass, Idaho fescue, Columbia needlegrass, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Columbia needlegrass decreases and the proportion of Idaho fescue, big sagebrush, lupine, hairy goldenaster, thickspike wheatgrass, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical. The surface layer of these soils is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. In places, brush control improves production of desirable forage plants. Steepness of slope limits access by livestock.

Windbreak management. The soils in this unit are poorly suited to windbreaks. They are limited mainly by steepness of slope.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe. The Earcree soil is in Sandy range site, 15- to 19-inch precipitation zone, and the Branham soil is in Shallow to Gravel range site, 15- to 19-inch precipitation zone. Rock outcrop is not placed in a range site.

45—Fluvaquentic Haplaquolls, nearly level. This map unit consists of deep, poorly drained and very poorly drained soils on bottom lands along streams and drainageways in foothills and valleys. These soils formed in alluvium. Slope is 0 to 2 percent. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

The soils in this unit are highly variable in texture, depth to gravel, and wetness. Texture is clay loam to cobbly sandy loam. Depth to sand and gravel is 10 to 40 inches. Periods of flooding are frequent to rare, and the seasonal high water table is at the surface to a depth of 40 inches.

This unit is used as rangeland.

Rangeland management. The potential native plant community is mainly tall reedgrass, tall sedges, American sloughgrass, brookgrass, water parsnip, willows, bogorchid, bog birch, and dogwood. If the rangeland is overgrazed, the proportion of tall reedgrass, American sloughgrass, and brookgrass

decreases and the proportion of sedges, water parsnip, bogorchid, bog birch, and dogwood increases. If overgrazing continues, plants such as Kentucky bluegrass, shrubby cinquefoil, Rocky Mountain iris, and annual forbs may invade. The potential native plant community produces 5,000 to 6,500 pounds of air-dry vegetation per acre per year, depending on soil conditions and degree of wetness.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by wetness and the hazard of flooding.

This map unit is in capability subclass Vw. It is in Wet Meadow range site, 10- to 14-inch precipitation zone.

46—Garlet very channery sandy loam, cool, 15 to 45 percent slopes. This deep, well drained soil is on moraines and mountainsides in the Madison Range. It formed in colluvium and glacial till derived from andesite, quartzite, and sandstone. Elevation is 8,000 to 9,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 32 degrees F, and the average frost-free period is about 30 days.

Included in this unit are small areas of poorly drained soils along drainageways, soils that have very steep, short slopes, very stony soils, and Rock outcrop. Included areas make up about 15 percent of the total acreage.

Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is pale brown very channery sandy loam about 15 inches thick. The subsoil is light yellowish brown very channery sandy loam 11 inches thick. The substratum to a depth of 60 inches or more is pale brown very channery sandy loam.

Permeability is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used as woodland and grazeable understory.

Rangeland management. The potential native understory is mainly grouse whortleberry, silvery lupine, and heartleaf arnica. The understory provides a limited amount of forage. The potential native forest understory produces about 200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 100 pounds in years of below-normal precipitation. Snowfall early in summer and late in summer commonly limits livestock use.

Forest management. This unit is suited to subalpine fir, whitebark pine, Engelmann spruce, and lodgepole pine. The site index for Engelmann spruce is 50. The potential annual production (CMAI) per acre of Engelmann spruce is about 38 cubic feet or 160 board feet (Scribner rule). Potential production is estimated for an even-aged, fully stocked stand of trees. The site index for whitebark pine is 34. Yield estimates for subalpine fir, whitebark pine, and lodgepole pine were not made.

The main limitation for timber management is slope. Steepness of slope limits the kinds of equipment that can be used. Understory vegetation competes with tree seedlings. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard if the soil in this unit is disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation. Windthrow can be a problem during periods of soil wetness and high winds.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIe, nonirrigated. It is in woodland suitability group 3R.

47—Garlet, cool-Rock outcrop complex, 45 to 70 percent slopes. This map unit is on mountainsides in the Madison Range. Elevation is 8,000 to 9,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 32 degrees F, and the average frost-free period is about 30 days.

This unit is about 70 percent Garlet very channery sandy loam and 20 percent Rock outcrop. The Garlet soil is on side slopes, and the Rock outcrop is on ridges and knolls.

Included in this unit are small areas of poorly drained soils along drainageways, very stony soils, and Cryoborolls. Included areas make up about 10 percent of the total acreage.

The Garlet soil is deep and well drained. It formed in colluvium derived from andesite, quartzite, and sandstone. Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is pale brown very channery sandy loam about 4 inches thick. The subsurface layer is pale brown very channery sandy loam about 11 inches thick. The subsoil is light yellowish brown very channery

sandy loam about 11 inches thick. The substratum to a depth of 60 inches or more is pale brown very channery sandy loam.

Permeability is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is more than 60 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

Rock outcrop is exposures of andesite and quartzite.

This unit is used as woodland and grazeable understory.

Rangeland management. The potential native understory on the Garlet soil is mainly grouse whortleberry, silvery lupine, and heartleaf arnica. The understory provides a limited amount of forage. The potential native forest understory produces about 200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 100 pounds in years of below-normal precipitation.

Snowfall early in summer and late in summer commonly limits use by livestock. Steepness of slope and the areas of Rock outcrop also limit access by livestock.

Forest management. The Garlet soil is suited to subalpine fir, whitebark pine, Engelmann spruce, and lodgepole pine. The site index for Engelmann spruce is 50. The potential annual production (CMAI) of Engelmann spruce is about 38 cubic feet or 160 board feet (Scribner rule) per acre. Potential production is estimated for an even-aged, fully stocked stand of trees. The site index for whitebark pine is 34. Yield estimates for subalpine fir, whitebark pine, and lodgepole pine were not made.

The main limitation for timber management is slope. Steepness of slope limits the kinds of equipment that can be used. Track-type tractors can be used effectively on most slopes; however, use of line skidding should be considered on the steepest slopes. Understory vegetation competes with tree seedlings. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard if the surface layer is disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation. Windthrow can be a hazard on the Garlet soil during periods of soil wetness and high winds.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated. It is in woodland suitability group 3R.

48—Gaylord-Burnette complex, 4 to 15 percent slopes. This map unit is on fans and foot slopes and in valleys in the northeastern part of the survey area. Slope is 4 to 15 percent. Elevation is 5,600 to 6,200 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 40 percent Gaylord loam and 40 percent Burnette clay loam. The Gaylord soil is on the less sloping terraces and in swales, and the Burnette soil is in the more sloping areas of the unit.

Included in this unit are small areas of poorly drained soils, deep clayey soils, and soils that are similar to this Gaylord soil but are underlain by semiconsolidated sandstone and shale at a depth of 20 to 40 inches. The poorly drained soils are in swales and along drainageways. The clayey soils are on ridgetops. The soils that have semiconsolidated sandstone and shale at a depth of 20 to 40 inches are along escarpments and in the steeper areas. Included areas make up about 20 percent of the total acreage.

The Gaylord soil is deep and well drained. It formed in alluvium derived from interbedded shale and sandstone. Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is light gray loam about 3 inches thick. The subsoil is pale brown clay about 13 inches thick. The substratum to a depth of 60 inches or more is pale brown and pale yellow silty clay. A few areas that have not been cultivated have a stony surface layer.

Permeability of the Gaylord soil is slow. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 22 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Burnette soil is deep and well drained. It formed in alluvium derived from interbedded shale and sandstone. Typically, the surface layer is very dark grayish brown clay loam about 13 inches thick. The subsoil is brown and pale brown clay about 13 inches thick. The substratum to a depth of 60 inches or more is light gray gravelly clay. A few areas that have not been cultivated have a stony surface layer.

Permeability of the Burnette soil is slow. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is rapid, and the hazard of water

erosion is high. The hazard of soil blowing is moderate.

This unit is used mainly for irrigated hay and nonirrigated pasture. It is also used as rangeland. The main crops are alfalfa and grass for hay and grass for pasture.

Cropland management. If the soils in this unit are used for irrigated hay or pasture, they are limited mainly by the short growing season. They are also limited by the hazards of soil blowing and water erosion and by runoff when the soils are tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. The soils in this unit are poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community on the soils in this unit is mainly Richardson needlegrass, Idaho fescue, basin wildrye, mountain brome, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of Richardson needlegrass, basin wildrye, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Grazing should be delayed until the soil has dried sufficiently and is firm enough to withstand trampling by livestock. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on these soils if the rangeland vegetation is in poor condition.

Windbreak management. The soils in this unit are well suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, these soils are also suited to cottonwood and golden willow trees.

Homesite development. The soils in this unit are poorly suited to homesite development. The main limitations are the potential for shrinking and swelling, low soil strength, potential frost action, and slow permeability. In the construction of basements or foundations for dwellings, the limitation of shrinking and swelling can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. The possibility of foundation failure because of low soil strength can be minimized by designing oversized footings and preparing a strong load-supporting base. If the soils are used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. Shrinking and swelling, frost action, and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Surfacing of roads is needed if they are to be used when wet.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

49—Hanson channery loam, 2 to 8 percent slopes. This deep, well drained soil is on fans, foot slopes, hillsides, and moraines throughout the survey area. It formed in calcareous alluvium, colluvium, and glacial till. Elevation is 5,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small, randomly distributed areas of soils that have a stony surface layer and soils that have few coarse fragments in the surface layer. Included areas make up about 10 percent of the total acreage.

Typically, the Hanson soil has a surface layer of gray channery loam about 11 inches thick. The underlying material to a depth of 60 inches or more is light gray and white very channery loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland.

Cropland management. This unit is suited to irrigated and nonirrigated hay and pasture. It is limited mainly by the short growing season and coarse fragments on the surface. It is also limited by the hazards of soil blowing and water erosion when the soil is tilled for seedbed preparation and planting. Farming on the contour or

across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Coarse fragments on the surface make seedbed preparation difficult. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Richardson needlegrass, basin wildrye, mountain brome, rough fescue, mountain big sagebrush, and Idaho fescue. If the rangeland is overgrazed, the proportion of basin wildrye, mountain brome, bluebunch wheatgrass, Richardson needlegrass, and rough fescue decreases and the proportion of Idaho fescue, prairie junegrass, lupine, mountain big sagebrush, and perennial forbs increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by coarse fragments on the surface, moderate permeability, and potential frost action. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. Frost action can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

50—Hanson channery loam, 8 to 45 percent slopes. This deep, well drained soil is on fans, foot slopes, hillsides, and moraines in the foothills of the survey area. It formed in calcareous alluvium, colluvium, and glacial till. Elevation is 5,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Tiban soils, soils that have a thick, dark-colored surface layer, and soils that have a stony surface layer. The Tiban soils are on foot slopes. The thick, dark-colored soils are mainly on foot slopes and in depressional areas on north-facing slopes. Included areas make up about 15 percent of the total acreage.

Typically, the Hanson soil has a surface layer of dark grayish brown and gray channery loam about 11 inches thick. The underlying material to a depth of 60 inches or more is light gray and white very gravelly loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of the steepness of slope and the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Richardson needlegrass, basin wildrye, mountain brome, rough fescue, mountain big sagebrush, and Idaho fescue. If the rangeland is overgrazed, the proportion of basin wildrye, mountain brome, bluebunch wheatgrass, Richardson needlegrass, and rough fescue decreases and the proportion of Idaho fescue, prairie junegrass, lupine, mountain big sagebrush, and perennial forbs increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

This unit is suited to mechanical practices such as scarification to improve areas of deteriorated rangeland where slope is less than 35 percent. The surface layer of the soil is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIe,

nonirrigated. It is in Thin Silty range site, 15- to 19-inch precipitation zone.

51—Hanson-Adel complex, 4 to 45 percent slopes. This map unit is on glacial moraines and in landslide areas in the southern part of the survey area. Elevation is 6,400 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 50 percent Hanson stony loam and 40 percent Adel loam. The Hanson soil is on hills and side slopes, and the gently rolling and strongly rolling Adel soil is on north-facing slopes and in swales and basins.

Included in this unit are small, randomly distributed areas of Tiban and Leavitt soils and Cryaquolls. Also included are areas of water that are less than 5 acres in size. Included areas make up about 10 percent of the total acreage.

The Hanson soil is deep and well drained. It formed in glacial till and alluvium derived from limestone. Typically, the surface layer is dark grayish brown stony loam about 7 inches thick. The upper 7 inches of the underlying material is very pale brown stony loam, and the lower part to a depth of 60 inches or more is very pale brown very cobbly loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 28 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate. This soil is calcareous below a depth of about 7 inches.

The Adel soil is deep and well drained. It formed in alluvium and eolian material. Typically, the surface layer is grayish brown loam about 23 inches thick. The subsoil to a depth of 60 inches or more is pale brown gravelly loam.

Permeability is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 60 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are very poorly suited to cultivated crops because of the short growing season and the short, steep slopes in some areas.

Rangeland management. The potential native plant community on the soils in this unit is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, mountain brome, basin wildrye, Richardson needlegrass, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, mountain brome, basin wildrye, rough fescue, and Richardson needlegrass decreases and the proportion of Idaho fescue, prairie junegrass, lupine, mountain big sagebrush, and perennial forbs increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

These soils are suited to mechanical practices such as scarification to improve areas of deteriorated rangeland where slopes are less than 35 percent. In places, brush control improves production of desirable forage plants. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope.

Homesite development. The soils in this unit are poorly suited to homesite development. Some areas of this unit are unstable and are moving downslope; therefore, onsite investigation of potential building sites is needed before starting construction. These unstable areas are below seeps and included areas of Cryaquolls.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

52—Hanson-Raynesford complex, 8 to 35 percent slopes. This map unit is on hills and foot slopes in the northeastern part of the survey area. Elevation is 5,000 to 7,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 50 percent Hanson stony loam and 40 percent Raynesford stony silt loam. The Hanson soil is on hills and steeper foot slopes, and the Raynesford soil is on less sloping hills and foot slopes and in swales and drainageways.

Included in this unit are small areas of deep, dark-colored soils, Rock outcrop, and clayey soils. The deep, dark-colored soils are in some drainageways and in swales. The Rock outcrop is on hilltops. The clayey soils are mainly in saddles between hills and in some places below areas of Rock outcrop. Also included are

small areas of soils that have a very stony surface layer and are randomly distributed throughout the unit. Included areas make up about 10 percent of the total acreage.

The Hanson soil is deep and well drained. It formed in colluvium derived dominantly from limestone. Typically, the surface layer is dark gray stony loam about 11 inches thick. The underlying material to a depth of 60 inches or more is very pale brown very channery loam.

Permeability of the Hanson soil is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Raynesford soil is deep and well drained. It formed in colluvium derived dominantly from limestone. Typically, the surface layer is very dark gray stony silt loam about 16 inches thick. The upper 4 inches of the underlying material is light gray gravelly silt loam, and the lower part to a depth of 60 inches or more is white and light gray gravelly silty clay loam.

Permeability of the Raynesford soil is moderately slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are very poorly suited to cultivated crops because of the steepness of slope, the short growing season, and the stones on the surface.

Rangeland management. The potential native plant community on the soils in this unit is mainly mountain brome, Richardson needlegrass, basin wildrye, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

These soils are suited to mechanical practices such as scarification to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope.

Homesite development. The main limitations for homesite development on the soils in this unit are steepness of slope, moderate permeability of the Hanson soil, and moderately slow permeability of the Raynesford soil. If the soils are used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

53—Hanson-Rock outcrop complex, 25 to 45 percent slopes. This map unit is on hills throughout the survey area. Elevation is 5,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 50 percent Hanson channery loam and 30 percent limestone Rock outcrop. The Hanson soil is on hillsides and foot slopes, and the Rock outcrop is on the steeper side slopes and on ridges.

Included in this unit are small areas of Tiban soils and soils that have a thick, dark-colored surface layer. The Tiban soils are on foot slopes. The thick, dark-colored soils are on foot slopes, in depressional areas, and on north-facing slopes. Also included are small areas of soils that have a stony loam surface layer. Included areas make up about 20 percent of the total acreage.

The Hanson soil is deep and well drained. It formed in colluvium derived dominantly from limestone. Typically, the surface layer is brown channery loam about 11 inches thick. The underlying material to a depth of 60 inches or more is very pale brown very channery and extremely channery loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is not suited to cultivated crops because of steepness of slope and the areas of Rock outcrop.

Rangeland management. The potential native plant community on the Hanson soil is mainly basin wildrye, mountain brome, bluebunch wheatgrass, Richardson needlegrass, rough fescue, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, basin wildrye, mountain brome, Richardson needlegrass, and rough fescue decreases and the proportion of Idaho fescue, prairie junegrass, lupine, mountain big sagebrush, and perennial forbs increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Use of mechanical treatment practices is not practical. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope and the areas of Rock outcrop.

This map unit is in capability subclass VIIe, nonirrigated. It is in Thin Silty range site, 15- to 19-inch precipitation zone.

54—Hapgood loam, moist, 2 to 8 percent slopes. This deep, well drained soil is on hills, ridges, and upland benches in the Centennial Valley. It formed in alluvium and colluvium derived from igneous rock. Elevation is 7,000 to 7,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Adel soils in swales. Also included are small areas of Rock outcrop and very stony soils along ridgetops and in drainageways extending from the ridgetops. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Hapgood soil is very dark grayish brown loam about 12 inches thick. The upper 5 inches of the subsoil is dark gray very gravelly loam, and the lower 11 inches is pale brown very gravelly loam. The substratum to a depth of 60 inches or more is light gray very gravelly loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland.

Cropland management. This unit is suited to irrigated and nonirrigated hay and pasture. It is limited mainly by the short growing season. It is also limited by the hazards of water erosion and soil blowing and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly basin wildrye, Columbia needlegrass, spike fescue, rough fescue, mountain brome, Richardson needlegrass, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Columbia needlegrass, spike fescue, rough fescue, mountain brome, and Richardson needlegrass decreases and the proportion of Idaho fescue, timber danthonia, Canby bluegrass, lupine, and mountain big sagebrush increases. If overgrazing continues, plants such as Canada bluegrass, Kentucky bluegrass, timothy, onespike danthonia, and annual forbs may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by moderate permeability. If the soil in this unit is used for septic

tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, 20- to 24-inch precipitation zone.

55—Hapgood loam, moist, 8 to 25 percent slopes. This deep, well drained soil is on hills, ridges, and in drainageways in the Centennial Valley. It formed in alluvium and colluvium derived from igneous rock. Elevation is 7,000 to 7,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Adel and Sebud soils, Rock outcrop, and stony soils. The Adel soils are in swales and on bottoms of drainageways. The Sebud soils, Rock outcrop, and stony soils are on moderately steep to steep side slopes. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Hapgood soil is very dark grayish brown loam about 12 inches thick. The upper 5 inches of the subsoil is dark gray very gravelly loam, and the lower 11 inches is pale brown very gravelly loam. The substratum to a depth of 60 inches or more is light gray very gravelly loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is poorly suited to cultivated crops because of the short growing season and steepness of slope.

Rangeland management. The potential native plant community is mainly basin wildrye, Columbia needlegrass, spike fescue, rough fescue, mountain brome, Richardson needlegrass, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Columbia needlegrass, spike fescue, rough fescue, mountain brome, and Richardson needlegrass decreases and the proportion of Idaho fescue, timber danthonia, Canby bluegrass, lupine, and mountain big sagebrush increases. If overgrazing continues, plants such as Canada bluegrass, Kentucky bluegrass, timothy, onespike danthonia, and annual forbs may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. The main limitations for homesite development on this unit are slope and moderate permeability. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, 20- to 24-inch precipitation zone.

56—Hapgood very stony loam, 4 to 15 percent slopes. This deep, well drained soil is on fans and foot slopes in the southeastern part of the county. It formed in alluvium and colluvium derived dominantly from igneous and metamorphic material. Slope is mainly 4 to 15 percent but is as much as 60 percent on the side slopes along Indian Creek, southeast of Cameron. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Sebud soils and Hapgood soils that have a nonstony surface layer. The Sebud soils are on low ridges and knolls on south-facing slopes, and the Hapgood soils that are nonstony are intermingled with areas of this Hapgood soil. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Hapgood soil is very dark grayish brown very stony loam about 18 inches thick. The underlying material to a depth of 60 inches or more is grayish brown very cobbly loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is

moderate. The hazard of soil blowing is slight.

This unit is used as rangeland. It is not suited to cultivated crops because of the high content of stones and the short growing season.

Rangeland management. The potential native plant community is mainly Richardson needlegrass, basin wildrye, mountain brome, rough fescue, bluebunch wheatgrass, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of Richardson needlegrass, basin wildrye, mountain brome, rough fescue, and bluebunch wheatgrass decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

This unit is not suited to mechanical treatment because of stones in the surface layer.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by stones in the surface layer.

Homesite development. The main limitations for homesite development on this unit are moderate permeability and the high content of stones. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Stoniness makes excavation, leveling, and road construction difficult.

This map unit is in capability subclass VIIs, nonirrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

57—Hapgood-Sebud very stony loams, 15 to 45 percent slopes. This map unit is on glacial moraines in the southern part of the Madison Valley. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 60 percent Hapgood very stony loam and 30 percent Sebud very stony loam. The Hapgood soil is on side slopes and in depressional areas, and the Sebud soil is on ridges and the steeper south-facing slopes.

Included in this unit are small, randomly distributed areas of Adel and Shadow soils, wet soils, and bouldery soils. Also are small areas of wet soils along drainageways. Included areas make up about 10 percent of the total acreage.

The Hapgood soil is deep and well drained. It formed in glacial till derived from gneiss and schist. Typically, the surface layer is very dark grayish brown very stony loam about 18 inches thick. The substratum to a depth of 60 inches or more is grayish brown very cobbly loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Sebud soil is deep and well drained. It formed in glacial till derived from gneiss and schist. Typically, the surface layer is dark grayish brown very stony loam about 14 inches thick. The subsoil is yellowish brown very stony sandy clay loam about 32 inches thick. The substratum to a depth of 60 inches or more is pale brown very stony sandy loam.

Permeability is moderate. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of slope, stoniness, and the short growing season. These soils support widely spaced trees. They are not an important source of timber, but selected trees can be harvested if it is economically feasible.

Rangeland management. The potential native plant community on the Hapgood soil is mainly mountain brome, Richardson needlegrass, basin wildrye, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

The potential native plant community on the Sebud soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch

wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The surface layer of the soils in this unit is susceptible to water erosion if it is disturbed or the rangeland is overgrazed. Use of mechanical treatment practices is not practical.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope and the very stony surface layer.

Homesite development. The main limitations for homesite development on the soils in this unit are slope, stoniness, and moderate permeability. If the soils are used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Stoniness makes excavation, leveling, and road construction difficult. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIIs, nonirrigated. The Hapgood soil is in Silty range site, dry, 20- to 24-inch precipitation zone, and the Sebud soil is in Silty range site, 15- to 19-inch precipitation zone.

58—Havre loam, cool, 0 to 2 percent slopes. This deep, well drained soil is on flood plains, low terraces, and fans in the intermontane valleys of the survey area. It formed in stratified loamy alluvium. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Ryell soils and deep sandy loam soils. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Havre soil is light brownish gray loam about 9 inches thick. The underlying material to a depth of 36 inches is light gray, dark grayish brown, and gray fine sandy loam and loam. Below this, to a depth of 60 inches or more, is light gray sandy loam and thin strata of loam and silt loam. In some areas the surface layer is clay loam.

Permeability is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is slow, and the hazard of water erosion is slight except during rare periods of flooding. The hazard of soil blowing is moderate.

This unit is used for irrigated crops and pasture and as rangeland. The main irrigated crops are grass, alfalfa, and small grain.

Cropland management. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leaving crop residue on or near the surface conserves moisture, increases the water intake rate, and improves tilth. If the soil is cultivated, fall plowing should be avoided to minimize soil blowing.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. The unit is suited to mechanical practices such as pitting, scalping, furrowing, and chiseling to improve areas of deteriorated rangeland.

Windbreak management. This unit is well suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding.

This map unit is in capability subclass IIIe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

59—Havre loam, cool, wet, 0 to 2 percent slopes. This deep, well drained soil is on terraces and flood plains in the intermontane valleys of the survey area. The soil formed in stratified loamy alluvium. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of soils on low knolls and ridges that have sandy and gravelly material at a depth of 10 to 40 inches. Also included are some areas of randomly distributed soils that are slightly saline or moderately saline and a few areas of soils that are similar to this Havre soil but have a water table within 42 inches of the surface. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Havre soil is dark brown loam about 9 inches thick. The underlying material to a depth of 60 inches or more is light grayish brown, stratified loam and clay loam.

Permeability is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is more than 60 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. A seasonal high water table fluctuates between depths of 42 and 60 inches from March through September. This soil is subject to occasional brief periods of flooding from April through June.

This unit is used for irrigated crops and pasture and as rangeland. The main irrigated crops are grass, clover, and small grain.

Cropland management. If this unit is used for irrigated small grain, it is limited by periods of wetness and the hazard of flooding. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leaving crop residue on or near the surface conserves moisture, increases the water intake rate, and improves tilth. If the soil is cultivated, fall plowing should be avoided to minimize soil blowing.

Rangeland management. The potential native plant community is mainly slough sedges, tall reedgrass, tufted hairgrass, slender wheatgrass, Nebraska sedge, shrubby cinquefoil, and Douglas hawthorn. If the rangeland is overgrazed, the proportion of tall reedgrass, tufted hairgrass, slender wheatgrass, and Nebraska sedge decreases and the proportion of bluegrasses, slough sedges, shrubby cinquefoil, and Douglas hawthorn increases. If overgrazing continues, plants such as Kentucky bluegrass, Rocky Mountain iris, Baltic rush, and foxtail barley may invade. The potential native plant community produces about 5,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 3,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. Use of mechanical equipment to improve forage production may be limited by wetness except in fall. Areas near irrigated areas are driest late in spring.

Windbreak management. This unit is suited to windbreaks. The seasonal high water table limits the choice of trees and shrubs to those that are water tolerant. Suitable trees for planting are cottonwood, golden willow, white willow, Russian olive, Siberian elm, Siberian crabapple, blue spruce, and Rocky Mountain juniper. Suitable shrubs are purpleosier willow, common chokecherry, lilac, and silver buffaloberry.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by wetness and the occasional periods of flooding.

This map unit is in capability subclass IIIw, nonirrigated and irrigated. It is in Subirrigated range site, 10- to 14-inch precipitation zone.

60—Kalsted loamy sand, 2 to 8 percent slopes. This deep, well drained soil is on terraces, mainly in the northwestern part of the survey area. It formed in wind-worked, calcareous alluvium. Elevation is 5,000 to 5,800 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Crago and Musselshell soils, mainly along intermittent drainageways and on slope breaks. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Kalsted soil is pale brown loamy sand about 12 inches thick. The upper 18 inches of the underlying material is white sandy loam, and the lower part to a depth of 60 inches or more is light gray gravelly sandy loam.

Permeability is moderately rapid. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. The soil is calcareous throughout.

This unit is used mainly for irrigated crops and as rangeland. The main irrigated crops are alfalfa for hay and grasses and legumes for pasture. Small grain and

potatoes are also grown. This unit is very poorly suited to nonirrigated cultivated crops. It is limited mainly by droughtiness.

Cropland management. If this unit is used for irrigated crops, it is limited by the hazard of soil blowing. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. If the soil is cultivated, fall plowing should be avoided to minimize soil blowing. Growing grasses and legumes for hay and pasture also reduces soil blowing. Yield of potatoes under a high level of management is about 27,500 pounds per acre. Where potatoes are grown, practices such as using field windbreaks and tall grass barriers and listing are needed to control soil blowing.

Rangeland management. The potential native plant community is mainly prairie sandreed, bluebunch wheatgrass, Indian ricegrass, needleandthread, threadleaf sedge, green sagewort, and yucca. If the rangeland is overgrazed, the proportion of prairie sandreed, bluebunch wheatgrass, and Indian ricegrass decreases and the proportion of needleandthread, sand dropseed, threadleaf sedge, prairie junegrass, green sagewort, and yucca increases. If overgrazing continues, plants such as annual bromes, rubber rabbitbrush, and broom snakeweed may invade. The potential native plant community produces about 2,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,400 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. The surface layer is susceptible to soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclasses VIe, nonirrigated, and IVe, irrigated. It is in Sands range site, 10- to 14-inch precipitation zone.

61—Kalsted sandy loam, 0 to 2 percent slopes. This deep, well drained soil is on terraces, mainly in the western part of the survey area. It formed in calcareous alluvium. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Crago soils. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Kalsted soil is pale brown sandy loam 7 inches thick. The upper 4 inches of the underlying material is very pale brown sandy loam, the next 19 inches is white sandy loam, and the lower part to a depth of 60 inches or more is pale brown gravelly sandy loam.

Permeability is moderately rapid, and the available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used primarily for irrigated crops, mainly alfalfa for hay and grasses and legumes for pasture, and as rangeland. Small grain and potatoes are also grown in some areas. The unit is also used for nonirrigated crops, mainly small grain and grass for pasture.

Cropland management. If this unit is used for irrigated crops, it is limited by the hazard of soil blowing. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. If furrow or corrugation irrigation systems are used, runs should be on the contour or across the slope. Leveling is needed for the efficient application and removal of irrigation water. Highly calcareous soil material may be exposed by land leveling. Crop yields from these areas can be improved by applying commercial fertilizer and barnyard manure and by growing green manure crops. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. If this unit is cultivated, fall plowing should be avoided to minimize soil blowing. Growing grass and legumes for hay and pasture also

reduces soil blowing. Under a high level of management, the yield of potatoes is about 27,500 pounds per acre. Where potatoes are grown, practices such as using field windbreaks and tall grass barriers and listing are needed during winter to prevent soil blowing.

If this unit is used for nonirrigated crops, it is limited by the hazard of soil blowing and droughtiness. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Suitable practices for reducing soil blowing are stripcropping, using tall grass barriers and field windbreaks, minimum tillage, stubble mulch tillage, and growing sod crops such as hay and pasture. Tall grass barriers trap snow, which increases the amount of moisture in the soil. If this unit is cultivated, fall plowing should be avoided to minimize soil blowing.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, Indian ricegrass, prairie sandreed, needleandthread, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, Indian ricegrass, and prairie sandreed decreases and the proportion of needleandthread, threadleaf sedge, prairie junegrass, blue grama, thickspike wheatgrass, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Sandy range site, 10- to 14-inch precipitation zone.

62—Kalsted sandy loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and hills, mainly in intermontane valleys. It formed in calcareous alluvium. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Crago and Scravo soils on narrow terrace breaks and in intermittent drainageways. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Kalsted soil is pale brown sandy loam 7 inches thick. The upper 4 inches of the underlying material is very pale brown sandy loam, the next 19 inches is white sandy loam, and the lower part to a depth of 60 inches or more is pale brown gravelly sandy loam; it has strata of loamy sand.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used primarily for irrigated crops, mainly alfalfa for hay and grasses and legumes for pasture, and as rangeland. Small grain and potatoes are also grown in some areas. The unit is also used for nonirrigated crops, mainly small grain and grass for pasture.

Cropland management. If this unit is used for irrigated crops, it is limited by medium runoff and the hazards of water erosion and soil blowing. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of water erosion. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. If this unit is cultivated, fall plowing should be avoided to minimize soil blowing. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion. Under a high level of management, the yield of potatoes is about 27,500 pounds per acre. Where potatoes are grown, practices such as using field windbreaks and tall grass barriers and listing are needed during winter to prevent soil blowing.

If this unit is used for nonirrigated crops, it is limited by the hazards of soil blowing and water erosion, droughtiness, and medium runoff. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grasses waterways; minimum tillage; stubble mulch tillage; and growing sod crops such as hay and pasture. Tall grass barriers trap snow, which increases the amount of moisture in the soil. If this unit is cultivated, fall plowing should be avoided to minimize soil blowing.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, Indian ricegrass, prairie sandreed, needleandthread, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, Indian ricegrass, and prairie sandreed decreases and the proportion of needleandthread, threadleaf sedge, prairie junegrass, blue grama, thickspike wheatgrass, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Sandy range site, 10- to 14-inch precipitation zone.

63—Kalsted sandy loam, 8 to 15 percent slopes. This deep, well drained soil is on hills and foot slopes, mainly in the western and northern parts of the survey area. It formed in calcareous alluvium. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Scravo and Crago soils on narrow terrace breaks and in intermittent drainageways. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Kalsted soil is pale brown sandy loam 7 inches thick. The upper 23 inches of the underlying material is white sandy loam, and the lower part to a depth of 60 inches or more is pale brown and very pale brown gravelly sandy loam.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used primarily for irrigated crops, mainly grass and legumes for hay and pasture, and as rangeland. Small grain is also grown in some areas. The unit is also used for nonirrigated crops, mainly small grain and grass for pasture.

Cropland management. If this unit is used for irrigated crops, it is limited by medium runoff and the hazards of water erosion and soil blowing. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of water erosion. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Conducting fieldwork on the contour or across the slope, where practical, reduces erosion and conserves moisture. Growing grasses and legumes for hay and pasture reduces soil blowing, runoff, and water erosion.

If this unit is used for nonirrigated crops, it is limited by the hazards of soil blowing and water erosion, droughtiness, and medium runoff. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; stubble mulch tillage; and growing sod crops such as hay and pasture. Tall grass barriers trap snow, which increases the amount of moisture in the soil. If this unit is cultivated, fall plowing should be avoided to minimize soil blowing.

Rangeland management. The potential native plant

community is mainly bluebunch wheatgrass, Indian ricegrass, prairie sandreed, needleandthread, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, Indian ricegrass, and prairie sandreed decreases and the proportion of needleandthread, threadleaf sedge, prairie junegrass, blue grama, thickspike wheatgrass, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by slope. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Sandy range site, 10- to 14-inch precipitation zone.

64—Kalsted gravelly sandy loam, 15 to 35 percent slopes. This deep, well drained soil is on hills, mainly in the western and northern parts of the survey area. It formed in calcareous alluvium. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Musselshell, Varney, and Yetull soils, areas of soils that have a cobbly surface layer, and areas of sandstone outcrop. The Musselshell soils and the soils that have a cobbly surface layer are scattered throughout the unit. The Varney soils are on north-facing slopes. The Yetull soils are in intermittent drainageways and are droughty. The sandstone outcrop is scattered throughout the unit but is mostly on ridgetops and in drainageways. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Kalsted soil is gray gravelly sandy loam 4 inches thick. The underlying material to a depth of 60 inches or more is light gray gravelly sandy loam. In some areas the surface layer is sandy loam.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used as rangeland. It is poorly suited to cultivated crops because of slope.

Rangeland management. The potential native plant community on this unit is mainly bluebunch wheatgrass, Indian ricegrass, prairie sandreed, needleandthread, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, Indian ricegrass, and prairie sandreed decreases and the proportion of needleandthread, threadleaf sedge, prairie junegrass, blue grama, thickspike wheatgrass, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. This unit is suited to mechanical practices such as scalping, pitting, and chiseling to improve areas of deteriorated rangeland.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. If this unit is used for homesite development, it is limited mainly by slope. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIe, nonirrigated. It is in Thin Sandy range site, 10- to 14-inch precipitation zone.

65—Larry Variant peat, 0 to 2 percent slopes. This deep, poorly drained soil is on stream terraces in the northeastern part of the survey area. It formed in alluvium. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Borohemists, very gravelly soils, sandy soils, and very poorly drained soils. The Borohemists and very poorly drained soils are in swales and in old meander channels. The very gravelly soils and the sandy soils are adjacent to drainageways. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer is very dark brown peat 5 inches thick. The next layer is dark gray loam about 7 inches thick. The upper 17 inches of the underlying material is gray clay loam, the next 8 inches is gray very gravelly sandy loam, and the lower part to a depth of 60 inches or more is light gray and gray very gravelly loamy sand.

Permeability is moderate to a depth of about 37 inches and rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 30 to 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. A seasonal high water table is at the surface to a depth of 18 inches from March through July. This soil is subject to rare, brief periods of flooding from January through April, when ice blocks the normal stream drainage.

This unit is used as rangeland and for nonirrigated hay. The main crops are grass and clover.

Cropland management. If this unit is used for crops, it is limited by wetness. The high water table in spring and early in summer limits tillage, seeding, and harvesting. Drainage systems can lower the water table, make tillage, seeding, and harvesting easier, and increase the yield and quality of forage.

Rangeland management. The potential native plant community is mainly tall reedgrass, slough sedges, tufted hairgrass, slender wheatgrass, Nebraska sedge, shrubby cinquefoil, and Douglas hawthorn. If the rangeland is overgrazed, the proportion of tall reedgrass, tufted hairgrass, slender wheatgrass, and Nebraska sedge decreases and the proportion of bluegrasses, slough sedges, shrubby cinquefoil, and Douglas hawthorn increases. If overgrazing continues, plants such as Kentucky bluegrass, Rocky Mountain iris, Baltic rush, and foxtail barley may invade. The potential native plant community produces about 5,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 3,000 pounds in years of below-normal precipitation.

Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Use of mechanical equipment to improve forage production may be limited by wetness except in fall. Areas near irrigated land are driest late in spring.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited by the seasonal high water table.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding. It is also limited by the seasonal high water table.

This map unit is in capability subclass Vw, nonirrigated. It is in Subirrigated range site, 10- to 14-inch precipitation zone.

66—Leavitt loam, moist, 2 to 15 percent slopes. This deep, well drained soil is on foot slopes and hills in the southeastern part of the survey area. It formed in alluvium. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small, randomly distributed areas of Adel, Bearmouth, and Hapgood soils. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Leavitt soil, where mixed to a depth of 7 inches, is very dark gray loam. The subsurface layer is dark grayish brown gravelly loam about 8 inches thick. The subsoil is brown gravelly clay loam about 25 inches thick. The substratum to a depth of 60 inches or more is pale yellow gravelly loam.

Permeability is moderate. Available water capacity is about 8 inches. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is calcareous below a depth of 40 inches.

This unit is used as rangeland.

Cropland management. This unit is suited to irrigated and nonirrigated pasture and hay. It is limited mainly by the short growing season. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the

previous crop. Sprinkler irrigation is the most suitable method of applying water. Minimum tillage, contour cultivation, use of grassed waterways, and stripcropping reduce soil blowing, runoff, and water erosion. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly basin wildrye, Richardson needlegrass, Idaho fescue, mountain brome, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Richardson needlegrass, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. The main limitations for homesite development on this unit are slope and moderate permeability. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

67—Leavitt cobbly loam, 2 to 8 percent slopes. This deep, well drained soil is mainly on fans, foot slopes, and hills in the southern parts of the Madison and Ruby Valleys and in the Sweetwater Basin. It formed in alluvium. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small, randomly distributed areas of Adel, Bridger, Libeg, and Tiban soils. Also included are small areas of soils that have a gravelly loam surface layer. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Leavitt soil, where mixed to a depth of 7 inches, is dark grayish brown cobbly loam. The subsoil is brown and pale brown gravelly clay loam about 14 inches thick. The substratum to a depth of 60 inches or more is light gray and white gravelly loam. In some areas the surface layer is loam. These areas are on terraces in the southern part of the Madison Valley.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. The soil is calcareous below a depth of about 21 inches.

This unit is used mainly as rangeland. It is also used for irrigated and nonirrigated hay and pasture. The main crops are alfalfa for hay and grass for hay and pasture.

Cropland management. This unit is suited to irrigated and nonirrigated hay and pasture. It is limited mainly by the short growing season. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Rock fragments in the surface layer may cause rapid wear of tillage and harvesting equipment. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass and wyethia

may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. The main limitation for homesite development on this unit is moderate permeability. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

68—Leavitt stony loam, 2 to 25 percent slopes. This deep, well drained soil is on hills, fans, terraces, and foot slopes in the southern part of the survey area. It formed in alluvium. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small, randomly distributed areas of Adel and Blaine soils and Rock outcrop. Also included are small areas of soils that have a clayey subsoil and soils that have an extremely stony surface layer. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Leavitt soil is dark grayish brown stony loam 4 inches thick. The upper 9 inches of the subsoil is brown stony clay loam, and the lower 8 inches is pale brown gravelly clay loam. The substratum to a depth of 60 inches or more is white and light gray gravelly loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate. This soil is calcareous below a depth of about 21 inches.

This unit is used as rangeland. It is very poorly suited to cultivated crops mainly because of the short growing season and stones in the surface layer.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

This unit is suited to mechanical practices such as scarification to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. The main limitations for homesite development on this unit are slope, stones in the surface layer, and moderate permeability. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. Stoniness makes excavation, leveling, and road construction difficult.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

69—Leavitt, moist-Adel complex, 4 to 15 percent slopes. This map unit is on dissected terraces in the southeastern part of the survey area. Elevation is 6,000 to 6,800 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 40 percent Leavitt gravelly loam and 40 percent Adel loam. The Leavitt soil is on terraces and escarpments, and the Adel soil is on north-facing slopes and in swales.

Included in this unit are small areas of Hanson, Hapgood, and Maxville soils. The Hanson soils are on ridges. The Maxville soils are on short, steep escarpments. The Hapgood soils are on the north-facing slopes of basins. Included areas make up about 20 percent of the total acreage.

The Leavitt soil is deep and well drained. It formed in calcareous alluvium. Typically, the surface layer is dark gray gravelly loam about 10 inches thick. The subsoil is pale brown gravelly clay loam about 25 inches thick. The upper 10 inches of the substratum is light gray gravelly loam, and the lower part to a depth of 60 inches or more is very pale brown very gravelly loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is calcareous below a depth of about 35 inches.

The Adel soil is deep and well drained. It formed in alluvial and eolian material. Typically, the surface layer is dark gray loam about 21 inches thick. The subsoil is pale brown clay loam about 34 inches thick. The substratum to a depth of 60 inches or more is white clay loam.

Permeability is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is calcareous below a depth of about 55 inches.

This unit is used as rangeland.

Cropland management. The soils in this unit are suited to irrigated and nonirrigated pasture and hay. They are limited mainly by the short growing season. They are also limited by the hazards of soil blowing and water erosion and by runoff when the soils are tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. The soils in this unit are poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community on the soils in this unit is mainly basin wildrye, Richardson needlegrass, mountain brome, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Richardson needlegrass, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and other perennial forbs increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on these soils if the rangeland vegetation is in poor condition. In places, brush control improves production of desirable forage plants.

Windbreak management. This unit is suited to windbreaks. The Leavitt soil has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting on the soils in this unit are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, these soils are also suitable for cottonwood and golden willow trees.

Homesite development. The main limitations for homesite development on the soils in this unit are slope, moderate permeability, potential frost action, and low soil strength. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. If these soils are used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Frost action and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

70—Libeg-Adel complex, 4 to 25 percent slopes. This map unit is on glacial moraines and hillsides and in old landslide areas in the southwestern part of the survey area. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 18 inches, the

average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 45 percent Libeg very stony loam and 35 percent Adel gravelly loam. The Libeg soil is on hills and side slopes, and the Adel soil is on foot slopes and in swales.

Included in this unit are small areas of Hapgood and Leavitt soils, very poorly drained soils, and clayey soils. The very poorly drained soils and the clayey soils are in swales and depressional areas. The Hapgood and Leavitt soils are randomly distributed throughout the unit. Included areas make up about 20 percent of the total acreage.

The Libeg soil is deep and well drained. It formed in glacial till and colluvium. Typically, the surface layer is very dark gray very stony loam about 7 inches thick. The upper 9 inches of the subsoil is grayish brown very stony clay loam, and the next 17 inches is light yellowish brown extremely stony clay loam. Below this to a depth of 60 inches or more is pale brown extremely stony sandy clay loam.

Permeability is moderate. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

The Adel soil is deep and well drained. It formed in colluvial and eolian material. Typically, the surface layer is brown gravelly loam about 21 inches thick. The subsoil to a depth of 60 inches or more is light brown gravelly loam.

Permeability is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the very stony texture of the Libeg soil, the rough and broken topography, and the short growing season.

Rangeland management. The potential native plant community on the Libeg soil is mainly bluebunch wheatgrass, rough fescue, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, prairie junegrass, and lupine increases. If overgrazing continues, plants such as Kentucky bluegrass, onespike danthonia, and wyethia may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,100 pounds in years of below-normal precipitation.

The potential native plant community on the Adel soil is mainly basin wildrye, Richardson needlegrass, mountain brome, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Richardson needlegrass, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical. The very stony surface layer of the Libeg soil and the rough, broken topography make the use of machinery difficult. In places, brush control improves production of desirable forage plants.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by the very stony surface layer of the Libeg soil and the steepness of slope.

Homesite development. The main limitations for homesite development on the Libeg soil are slope, moderate permeability, potential frost action, low soil strength, and content of large stones. The main limitations on the Adel soil are slope, moderate permeability, potential frost action, and low soil strength. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. If the soils are used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Frost action and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Stoniness makes excavation, leveling, and road construction difficult on the Libeg soil.

This map unit is in capability subclass VIIs, nonirrigated. The Libeg soil is in Silty range site, stony, 15- to 19-inch precipitation zone, and the Adel soil is in

Silty range site, dry, 20- to 24-inch precipitation zone.

71—Libeg-Hapgood complex, 15 to 45 percent slopes. This map unit is on glacial moraines and old landslides in the central part of the survey area. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 60 percent Libeg very stony loam and 20 percent Hapgood stony loam. The Libeg soil is on hills and the upper part of slopes. The Hapgood soil is in swales and on foot slopes and north-facing slopes.

Included in this unit are small areas of Adel, Leavitt, and Tiban soils. The Adel soil is in swales and on north-facing slopes. The Leavitt and Tiban soils are on south-facing slopes and in areas where limy parent material is present. Included areas make up about 20 percent of the total acreage.

The Libeg soil is deep and well drained. It formed in colluvium and glacial till. Typically, the surface layer is grayish brown very stony loam about 13 inches thick. The upper 17 inches of the subsoil is pale brown very cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown very cobbly sandy clay loam.

Permeability is moderate. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Hapgood soil is deep and well drained. It formed in colluvium, alluvium, and glacial till. Typically, the surface layer is very dark grayish brown stony loam about 18 inches thick. The subsoil is brown very cobbly loam about 10 inches thick. The substratum to a depth of 60 inches or more is grayish brown very cobbly loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the stones in the surface layer of the soils, steepness of slope, and the short growing season.

Rangeland management. The potential native plant community on the Libeg soil is mainly bluebunch wheatgrass, rough fescue, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, prairie junegrass, and lupine increases. If overgrazing continues, plants such as Kentucky bluegrass, onespike danthonia, and wyethia may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,100 pounds in years of below-normal precipitation.

The potential native plant community on the Hapgood soil is mainly basin wildrye, Richardson needlegrass, mountain brome, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Richardson needlegrass, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as Kentucky bluegrass and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Use of mechanical treatment practices is not practical because of the stones in the surface layer of the soils.

Windbreak management. This unit is very poorly suited to windbreaks. They are limited mainly by steepness of slope and stones in the surface layer.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIs, nonirrigated. The Libeg soil is in Silty range site, stony, 15- to 19-inch precipitation zone, and the Hapgood soil is in Silty range site, dry, 20- to 24-inch precipitation zone.

72—Loberg very stony loam, 15 to 45 percent slopes. This deep, well drained soil is on glacial moraines and mountainsides. It is mainly in the south-central part of the Madison Range. It formed in colluvium and glacial till derived from mixed rock sources. Elevation is 6,500 to 8,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

Included in this unit are small areas of Whitore, Worock, and Mikesell soils. Also included are small areas of Rock outcrop. The Whitore soils are near the tops of ridges. The Mikesell soils have a few rock

fragments on the surface and are mainly on foot slopes. The Worock soils are randomly distributed throughout the unit. The Rock outcrop is mainly on ridgetops. Included areas make up about 15 percent of the total acreage.

Typically, the surface of this Loberg soil is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is pinkish gray very stony loam about 11 inches thick. The upper 7 inches of the subsoil is brown very stony clay loam, the next 24 inches is reddish brown very stony clay, and the lower part to a depth of 60 inches or more is reddish gray very stony clay.

Permeability is slow. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 60 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

This unit is used as woodland. It also produces understory vegetation suitable for grazing.

Rangeland management. The potential native forest understory is mainly heartleaf arnica, western meadowrue, pinegrass, and grouse whortleberry. The potential native understory produces about 800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

Use of mechanical treatment practices is not practical.

Forest management. This unit is suited to Douglas fir, lodgepole pine, Engelmann spruce, and subalpine fir. The site index is 54 for Douglas fir, 63 for lodgepole pine, and 49 for Engelmann spruce. The potential annual production (CMAI) per acre is about 75 cubic feet or 250 board feet (Scribner rule) for Douglas fir, 60 cubic feet or 170 board feet for lodgepole pine, and 70 cubic feet or 220 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

The main limitations for timber management are stones, slope, low soil strength, and the hazard of erosion. Steepness of slope and stones on the surface limit the kinds of equipment that can be used. Water erosion is a hazard on this unit if it is disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. Roads require suitable subgrade material because of the low strength and seasonal wetness of the soil. Stoniness makes excavation, leveling, and road construction difficult. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by slope, slow permeability, low soil strength, and stones.

This map unit is in capability subclass VIIs, nonirrigated. It is in woodland suitability group 5R.

73—MacFarlane stony sandy loam, 15 to 45 percent slopes. This deep, well drained soil is mainly on glacial moraines and mountainsides. It formed in glacial till and colluvium. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

Included in this unit are small areas of Mikesell, Shadow, and Loberg soils and very stony soils. The Mikesell soils are mainly on foot slopes and along drainageways. The Loberg and Shadow soils are on foot slopes. Also included are small areas of MacFarlane soils in the lower lying areas that support stands of Douglas fir. Included areas make up about 15 percent of the total acreage.

Typically, the surface of this MacFarlane soil is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is pinkish gray stony sandy loam about 14 inches thick. The subsoil is yellowish brown very channery sandy loam about 56 inches thick. The substratum to a depth of 80 inches or more is light yellowish brown very cobbly loamy sand. In some areas on glacial outwash terraces in the Gravelly Range south of Virginia City, the surface layer is stony loam and slopes are mainly 4 to 15 percent.

Permeability is moderately rapid. Available water capacity is about 4 inches. Effective rooting depth is 80 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 80 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly grouse whortleberry, blue huckleberry, white spirea, and silvery lupine. The understory provides a limited amount of forage. It produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation.

Forest management. This unit is suited to lodgepole

pine, Douglas fir, Engelmann spruce, and subalpine fir. The site index is 64 for lodgepole pine, 57 for Douglas fir, and 77 for Engelmann spruce. The potential annual production (CMAI) per acre is about 60 cubic feet or 180 board feet (Scribner rule) for lodgepole pine, 80 cubic feet or 290 board feet for Douglas fir, and 70 cubic feet or 320 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

The main limitation for timber management is slope. Steepness of slope limits the kinds of equipment that can be used. The understory vegetation competes with tree seedlings. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Windthrow can be a hazard during periods of soil wetness and high winds. Water erosion is a hazard on this unit if it is disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. If this unit is used for roads, it is limited mainly by slope, stoniness, and potential frost action. Stoniness makes excavation, leveling, and road construction difficult. Access roads must be designed to control surface runoff and to help stabilize cuts. Frost action can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIe, nonirrigated. It is in woodland suitability group 5R.

74—MacFarlane very stony sandy loam, warm, 15 to 45 percent slopes. This deep, well drained soil is on mountainsides. It formed in colluvium. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Shadow and Comad soils and Rock outcrop. The Rock outcrop is mainly on ridgetops. The Shadow and Comad soils are randomly distributed throughout the unit. Included areas make up about 15 percent of the total acreage.

Typically, the surface of this MacFarlane soil is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is pinkish gray very stony sandy loam about 14 inches thick. The subsoil is yellowish brown very channery sandy loam about 56 inches thick. The substratum to a depth of 80 inches or more is light yellowish brown very cobbly loamy sand.

Permeability is moderately rapid. Available water capacity is about 4 inches. Effective rooting depth is 80 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 80 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly pinegrass, raceme pussytoes, common snowberry, heartleaf arnica, and Woods rose. The understory provides a limited amount of forage. It produces about 600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 300 pounds in years of below-normal precipitation.

Forest management. This unit is suited to Douglas fir and lodgepole pine. The site index is 42 for Douglas fir and 65 for lodgepole pine. The potential annual production (CMAI) per acre is about 50 cubic feet or 160 board feet (Scribner rule) for Douglas fir and 60 cubic feet or 180 board feet for lodgepole pine. Potential production is estimated for an even-aged, fully stocked stand of trees.

The main limitation for timber management is slope. Steepness of slope limits the kinds of equipment that can be used. The understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. If this unit is used for roads, it is limited mainly by slope, stoniness, and potential frost action. Stoniness makes excavation, leveling, and road construction difficult. Access roads must be designed to control surface runoff and to help stabilize cuts. Frost action can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIs, nonirrigated. It is in woodland suitability group 4R.

75—Marias silty clay loam, cool, 2 to 8 percent slopes. This deep, well drained soil is on foot slopes in the northeastern part of the survey area. It formed in Tertiary lake sediment. Elevation is 4,500 to 5,000 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of soils that are shallow to bedrock and small areas of Amsterdam soils. The shallow soils are on hilltops and knobs. The Amsterdam soils are randomly distributed throughout the unit. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Marias soil is gray silty clay loam about 6 inches thick. The subsurface layer is light gray silty clay loam about 9 inches thick. The upper part of the underlying material is light gray and pale brown silty clay 17 inches thick, and the lower part to a depth of 60 inches or more is light grayish brown silty clay loam.

Permeability is very slow. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used for irrigated and nonirrigated crops. The main crops are small grain, hay, and pasture.

Cropland management. This unit is suited to irrigated and nonirrigated crops. It is limited mainly by the hazards of soil blowing and water erosion. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Sprinkler and flood irrigation is suited to this unit. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit.

Windbreak management. This unit is well suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. The main limitations for homesite development on this unit are the very slow permeability of the soil, low soil strength, and the potential for shrinking and swelling. If the soil is used for septic tank absorption fields, the limitation of very slow permeability can be overcome by increasing the size of the absorption field. Use of sandy backfill for the trench and long absorption lines helps to compensate for the very slow permeability. In the construction of basements or foundations for dwellings, the limitation of shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. The possibility of foundation failure because of low soil strength can be minimized by designing oversized footings and preparing a strong load-supporting base. Low soil strength and shrinking and swelling can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Roads become rutted if traveled when wet. Surfacing of roads is needed if they are to be used when wet.

This map unit is in capability subclass IVe, nonirrigated and irrigated.

76—Maxville gravelly loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the southeastern part of the survey area. It formed in alluvium. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Bearmouth, Tiban, and Adel soils. The Bearmouth soil is on terrace edges and in small areas in an irregular pattern throughout the unit. The Tiban soil is on side slopes along drainageways. The Adel soil is in depressional areas and drainageways. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Maxville soil is dark grayish brown gravelly loam about 11 inches thick. The subsoil is grayish brown loam about 8 inches thick. The upper 15 inches of the substratum is pale brown loam and gravelly loam, and the lower part to a depth of 60 inches or more is pale brown very gravelly loamy sand. In some areas the surface layer is silt loam.

Permeability is moderate to a depth of about 34 inches and rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. Some areas are used for nonirrigated pasture and irrigated pasture and hay.

Cropland management. If this unit is used for irrigated hay and pasture, it is limited mainly by the short growing season. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly Richardson needlegrass, basin wildrye, mountain brome, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of Richardson needlegrass, basin wildrye, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The moderate available water capacity limits the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. This unit is suited to windbreaks. It has limited available water capacity, which restricts growth of trees and shrubs. If the soil in this unit is used for septic tank absorption fields, the limitation of rapid permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

77—Maxville cobbly loam, dry, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the southeastern part of the survey area. It formed in eolian material overlying gravelly alluvium. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Leavitt and Tiban soils. The Leavitt soils are in depressional areas, and the Tiban soils are on low ridges and in drainageways. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Maxville soil is grayish brown cobbly loam about 8 inches thick. The subsoil is light yellowish brown loam about 13 inches thick. The upper 5 inches of the substratum is very pale brown gravelly loam, and the lower part to a depth of 60 inches or more is light brownish gray very gravelly loamy sand.

Permeability is moderate to a depth of about 26 inches and rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. It is also used for nonirrigated pasture and irrigated pasture and hay.

Cropland management. If this unit is used for irrigated hay and pasture and nonirrigated pasture, it is limited mainly by the cobbles in the surface layer and the short growing season. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Rock fragments in the surface layer can cause rapid wear of tillage and harvesting equipment. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If

the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, timothy, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. This unit is suited to mechanical practices such as scalping, pitting, furrowing, and chiseling to improve areas of deteriorated rangeland.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by the rapid permeability of the lower part of the substratum. If the soil in this unit is used for septic tank absorption fields, the limitation of rapid permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

78—Maxville, dry-Bearmouth complex, 0 to 8 percent slopes. This map unit is on fans and terraces in the southern part of the Madison Valley. Elevation is 6,000 to 6,400 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 50 percent Maxville loam and 40 percent Bearmouth extremely stony loam.

Included in this unit are small areas of Adel, Beaverell, and Leavitt soils. The Adel soils are in swales and on north-facing slopes, the Beaverell soils are on lower slopes, and the Leavitt soils are on upper slopes. Included areas make up about 10 percent of the total acreage.

The Maxville soil is deep and well drained. It formed in eolian material overlying gravelly and sandy alluvium. Typically, the surface layer is grayish brown loam about 8 inches thick. The subsoil is light yellowish brown loam 13 inches thick. The upper 5 inches of the substratum is very pale brown gravelly loam, and the lower part to a depth of 60 inches or more is light brownish gray extremely gravelly loamy sand.

Permeability is moderate to a depth of about 26 inches and rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Bearmouth soil is deep and well drained. It formed in gravelly and sandy alluvium. Typically, the surface layer is grayish brown extremely stony loam about 7 inches thick. The subsoil is very pale brown very stony loam about 9 inches thick. The substratum to a depth of 60 inches or more is extremely gravelly loamy sand. Gravelly and sandy material is at a depth of 10 to 20 inches.

Permeability is moderate to a depth of about 16 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the short growing season and the high content of stones in the Bearmouth soil.

Rangeland management. The potential native plant community on the Maxville soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, timothy, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential native plant community on the Bearmouth soil is mainly bluebunch wheatgrass, Idaho fescue, needleandthread, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch

wheatgrass decreases and the proportion of Idaho fescue, big sagebrush, skunkbush sumac, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, timothy, and wyethia may invade. The potential native plant community produces about 1,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

This unit is not suited to mechanical treatment because of the extremely stony surface layer of the Bearmouth soil.

Windbreak management. The Maxville soil is suited to windbreaks. It has limited available water capacity, however, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this soil is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

The Bearmouth soil is very poorly suited to windbreaks. It is limited by droughtiness and the extremely stony surface layer.

Homesite development. The main limitations for homesite development on the Bearmouth soil are the rapid permeability of the substratum and the high content of stones in the surface layer. The Maxville soil is limited by the rapid permeability of the lower part of the substratum. If the soils in this unit are used for septic tank absorption fields, the limitation of rapid permeability can be overcome by increasing the size of the absorption field. Because the substratum is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water. Stoniness makes excavation, leveling, and road construction difficult on the Bearmouth soil.

This map unit is in capability subclass VIIs, nonirrigated. The Maxville soil is in Silty range site, 15- to 19-inch precipitation zone, and the Bearmouth soil is in Shallow to Gravel range site, stony, 15- to 19-inch precipitation zone.

79—Maxville-Bearmouth complex, rarely flooded, 0 to 4 percent slopes. This map unit is on low terraces and fans along major streams and rivers throughout the survey area. It is subject to brief, rare periods of flooding from spring runoff during April through June. A seasonal high water table fluctuates between depths of 48 and 72 inches during April through June. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is 50 percent Maxville loam and 40 percent Bearmouth extremely stony loam. The Maxville soil is in swales and old stream channels, and the Bearmouth soil is in high spots throughout the unit.

Included in this unit are small areas of wet soils in low spots. Also included are small areas of nonstony Bearmouth soils that are 20 to 40 inches deep over gravelly and sandy material. Included areas make up about 10 percent of the total acreage.

The Maxville soil is deep and well drained. It formed in alluvium. Typically, the surface layer is dark grayish brown loam about 9 inches thick. The subsoil is grayish brown loam about 12 inches thick. The upper 8 inches of the substratum is white loam, the next 7 inches is light gray gravelly loam, and the lower part to a depth of 60 inches or more is pale brown very gravelly loamy sand.

Permeability of the Maxville soil is moderate to a depth of about 36 inches and rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 30 inches. Runoff is slow, and the hazard of water erosion is slight except during rare periods of flooding. The hazard of soil blowing is moderate.

The Bearmouth soil is deep and well drained. It formed in stony alluvium overlying sand and gravel. Typically, the surface layer is dark grayish brown extremely stony loam about 6 inches thick. The upper 6 inches of the subsoil is brown very stony loam, and the lower 8 inches is brown very stony sandy loam. The substratum to a depth of 60 inches or more is extremely gravelly loamy sand. Gravelly and sandy material is at a depth of 10 to 20 inches.

Permeability of the Bearmouth soil is moderate to a depth of about 20 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the short growing season and because of the stoniness and droughtiness of the Bearmouth soil.

Rangeland management. The potential native plant community on the Maxville soil is mainly mountain brome, Richardson needlegrass, basin wildrye, Idaho fescue, bluebunch wheatgrass, rough fescue, and

mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

The potential native plant community on the Bearmouth soil is mainly bluebunch wheatgrass, Idaho fescue, needleandthread, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of Idaho fescue, big sagebrush, skunkbush sumac, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, timothy, and wyethia may invade. The potential native plant community produces about 1,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical on this unit because of the extremely stony surface layer of the Bearmouth soil.

Windbreak management. The Maxville soil is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this soil is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

The Bearmouth soil is very poorly suited to windbreaks. It is limited by droughtiness and the extremely stony surface layer.

Homesite development. These soils are poorly suited to homesite development because of the rare periods of flooding.

This map unit is in capability subclass VIIs, nonirrigated. The Maxville soil is in Silty range site, dry, 20- to 24-inch precipitation zone, and the Bearmouth soil is in Shallow to Gravel range site, stony, 15- to 19-inch precipitation zone.

80—Mikesell clay loam, 15 to 45 percent slopes. This deep, well drained soil is on mountainsides and foot slopes. It formed in material derived from shale. Elevation is 6,500 to 8,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

Included in this unit are small, randomly distributed areas of Loberg soils and soils that have shale at a depth of 40 to 60 inches. Also included are small areas of poorly drained soils along drainageways and below springs. Included areas make up about 15 percent of the total acreage.

Typically, the surface of the Mikesell soil is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light brownish gray clay loam about 8 inches thick. The upper 6 inches of the subsoil is very pale brown clay, and the lower part to a depth of 60 inches or more is brown shaly clay.

Permeability is slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly heartleaf arnica, western meadowrue, pinegrass, and grouse whortleberry. The understory provides a moderate amount of forage. It produces about 800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas.

Forest management. This unit is suited to lodgepole pine, Engelmann spruce, Douglas fir, and subalpine fir. The site index is 67 for lodgepole pine, 84 for Engelmann spruce, and 52 for Douglas fir. The potential annual production (CMAI) per acre is about 65 cubic feet or 190 board feet (Scribner rule) for lodgepole pine, 80 cubic feet or 360 board feet for Engelmann spruce, and 75 cubic feet or 250 board feet for Douglas fir. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

The main limitations for timber management are slope and the content of clay. Steepness of slope limits the kinds of equipment that can be used. The soil in this unit has low strength when wet. This results in poor trafficability and the possibility of soil compaction when heavy equipment is used to yard logs. Operating equipment only when the soil is dry or frozen can overcome this limitation. Water erosion is a hazard if the soil in this unit is disturbed. Maintaining plant cover

in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation. This unit has a high potential for massive soil movement. Activities that concentrate runoff or intersect areas that have ground water at a shallow depth may result in slope failure. Seedling mortality and plant competition are concerns, especially if the overstory is completely removed.

Roads. If this unit is used for roads, it is limited mainly by steepness of slope, low soil strength, the potential for shrinking and swelling, potential frost action, and unstable slopes. The soil in this unit has high potential for massive soil movement. Onsite investigation should be made before attempting road construction. Shrinking and swelling, frost action, and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by steepness of slope, the potential for shrinking and swelling, unstable slopes, and slow permeability.

This map unit is in capability subclass VIe, nonirrigated. It is in woodland suitability group 6R.

81—Mikesell clay loam, 45 to 60 percent slopes. This deep, well drained soil is on mountainsides. It formed in material derived from shale. Elevation is 6,500 to 8,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

Included in this unit are small, randomly distributed areas of Loberg and Worock soils and soils that have shale at a depth of 40 to 60 inches. Also included are small areas of poorly drained soils along drainageways. Included areas make up about 15 percent of the total acreage.

Typically, the surface of the Mikesell soil is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light brownish gray clay loam about 8 inches thick. The upper 6 inches of the subsoil is very pale brown clay, and the lower part to a depth of 60 inches or more is brown and light gray shaly clay.

Permeability is slow. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly heartleaf arnica, western meadowrue, pinegrass, and grouse whortleberry. The understory provides a moderate amount of forage. It produces about 800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

Forest management. This unit is suited to lodgepole pine, Engelmann spruce, Douglas fir, and subalpine fir. The site index is 67 for lodgepole pine, 84 for Engelmann spruce, and 52 for Douglas fir. The potential annual production (CMAI) per acre is about 65 cubic feet or 190 board feet (Scribner rule) for lodgepole pine, 80 cubic feet or 360 board feet for Engelmann spruce, and 75 cubic feet or 250 board feet for Douglas fir. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

The main limitations for timber management are slope and the content of clay. Steepness of slope limits the kinds of equipment that can be used. Track-type tractors can be used effectively on most slopes; however, line skidding should be considered for use on the steeper slopes. The soil has low strength when wet. This results in poor trafficability and the possibility of soil compaction when heavy equipment is used to yard logs. Operating equipment only when the soil is dry or frozen can overcome this limitation. Water erosion is a hazard if the soil in this unit is disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation. Seedling mortality and plant competition are concerns, especially if the overstory is completely removed. The soil in this unit has a high potential for massive soil movement. Activities that concentrate runoff or intersect areas that have ground water at a shallow depth may result in slope failure.

Roads. If this unit is used for roads, it is limited mainly by steepness of slope, low soil strength, the potential for shrinking and swelling and for frost action, and unstable slopes. The soil in this unit has high potential for massive soil movement. Onsite investigation should be made before attempting road

construction. Shrinking and swelling, frost action, and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by steepness of slope, the potential for shrinking and swelling, unstable slopes, and slow permeability.

This map unit is in capability subclass VIIe, nonirrigated. It is in woodland suitability group 6R.

82—Musselshell loam, cool, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the Madison and Ruby Valleys. It formed in alluvium derived dominantly from limestone. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Amesha and Crago soils. Also included are small areas of Musselshell soils that have slopes of less than 2 percent or more than 8 percent. The very gravelly Crago soils are mainly on terrace edges and along intermittent drainageways. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Musselshell soil is light brownish gray and pale brown loam about 8 inches thick. The upper 17 inches of the underlying material is white and very pale brown loam and gravelly loam, the next 16 inches is white very gravelly loam, and the lower part to a depth of 60 inches or more is light gray very gravelly sandy loam. Areas in the Ruby Valley have a surface layer of gravelly loam.

Permeability is moderate to a depth of about 41 inches and moderately rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used as rangeland and for irrigated crops, mainly alfalfa, grass for pasture, and small grain. It is also used for nonirrigated grass for pasture. Nonirrigated small grain is grown in some areas.

Cropland management. If this unit is used for cultivated crops, it is limited by the hazards of soil blowing and water erosion and the moderate available water capacity. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. The surface layer is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. If the soil in this unit is cultivated, fall plowing should be avoided to minimize soil blowing. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Suitable methods for reducing soil blowing are stripcropping, using tall grass barriers and field windbreaks, minimum tillage, and stubble mulch tillage. Tall grass barriers trap snow, which increases the amount of moisture in the soil. Leaving crop residue on or near the surface conserves moisture, increases the water intake rate, and improves tilth. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

83—Musselshell gravelly loam, cool, 0 to 2 percent slopes. This deep, well drained soil is on terraces between Ennis and Cameron. It formed in alluvium derived dominantly from limestone. Elevation is 5,000 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Amesha and Crago soils. The very gravelly Crago soils are mainly on terrace edges and along intermittent drainageways. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Musselshell soil is light brownish gray gravelly loam about 8 inches thick. The upper 17 inches of the underlying material is white gravelly loam, the next 25 inches is light gray very gravelly loam and sandy loam, and the lower part to a depth of 60 inches or more is light gray very gravelly loamy sand. Gravelly and sandy material is at a depth of 35 to 60 inches.

Permeability is moderate to a depth of about 50 inches and moderately rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is calcareous throughout. It is droughty because of the high content of coarse fragments and the sandy texture of the lower part of the soil.

This unit is used as rangeland and for irrigated crops, mainly alfalfa, grass for pasture, and small grain. It is also used for nonirrigated grass for pasture. Nonirrigated small grain is grown in some areas.

Cropland management. If this unit is used for cultivated crops, it is limited by the hazard of soil blowing and the low available water capacity. Border and sprinkler irrigation is suited to this unit. Leveling is needed for the efficient application and removal of irrigation water. Because the soil in this unit is droughty, light and frequent applications of irrigation water are needed. The surface layer is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility.

If the soil is cultivated, fall plowing should be avoided to minimize soil blowing. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Suitable methods for reducing soil blowing are stripcropping, using tall grass barriers and field windbreaks, minimum tillage, and stubble mulch tillage. Tall grass barriers trap snow, which increases the amount of moisture in the soil. Leaving crop residue on or near the surface conserves moisture, increases the water intake rate, and improves tilth. Growing grasses and legumes for hay and pasture also reduces soil blowing. Gravel in the surface layer may cause rapid wear of tillage equipment.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of the soil in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. The high content of lime in this soil limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

84—Musselshell-Amesha, bedrock substratum, complex, cool, 8 to 25 percent slopes. This map unit is on dissected terraces on uplands in the Ruby Valley. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 50 percent Musselshell gravelly loam and 30 percent Amesha loam. The Amesha soil is mainly on hilltops and the upper part of slopes. The Musselshell soil is mainly on the lower part of slopes and in intermittent drainageways.

Included in this unit are small areas of Trimad, Blackhall, and Varney soils. The Trimad and Blackhall soils are mainly on hilltops and steep terrace breaks. The Varney soils are mainly on foot slopes and in depressional areas. Included areas make up about 20 percent of the total acreage.

The Musselshell soil is deep and well drained. It formed in alluvial and eolian material derived mainly from limestone. Typically, the surface layer is light brownish gray gravelly loam about 8 inches thick. The upper 17 inches of the underlying material is white loam, and the lower part to a depth of 60 inches or more is light gray very gravelly loam.

Permeability is moderate to a depth of about 25 inches and moderately rapid below this depth. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

The Amesha soil is deep and well drained. It formed in alluvium derived from soft loamy sedimentary beds. Typically, the surface layer is grayish brown loam about 8 inches thick. The upper 27 inches of the underlying material is light gray loam, and the lower part to a depth of about 52 inches is loam with thin strata of silt loam and sandy loam. Loamy sedimentary beds are at a depth of 52 inches. Depth to sedimentary beds is 40 to 60 inches.

Permeability is moderate. Available water capacity is about 8 inches. Effective rooting depth is 40 to 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used as rangeland. It is poorly suited to cultivated crops because of slope.

Rangeland management. The potential native plant community on the soils in this unit is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is very poorly suited to windbreaks. The main limitation is the steepness of slope.

Homesite development. The main limitation for homesite development on the Musselshell soil is slope. The Amesha soil is limited by depth to soft loamy sedimentary beds, slope, and moderate permeability. Deep cuts needed to provide nearly level road surfaces can expose the sedimentary beds, which can easily be excavated. If the Amesha soil is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Excavation for roads can expose material that is highly susceptible to water erosion. Making low-gradient cuts and fills and establishing a suitable plant cover reduce water erosion.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

85—Musselshell-Crago complex, cool, 2 to 8 percent slopes. This map unit is on terraces and fans in the Madison and Ruby Valleys. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 50 percent Musselshell loam and 30 percent Crago gravelly loam. The Crago soil is in narrow, discontinuous areas that are slightly higher lying than areas of the Musselshell soil.

Included in this unit is about 15 percent randomly distributed areas of Crago loam. Also included is about 5 percent very droughty Scravo soils, mainly on low terrace breaks and in narrow intermittent stream channels.

The Musselshell soil is deep and well drained. It formed in alluvium derived dominantly from limestone. Typically, the surface layer is light brownish gray loam about 8 inches thick. The upper 17 inches of the underlying material is white gravelly loam, the next 25

inches is light gray very gravelly sandy loam, and the lower part to a depth of 60 inches or more is very gravelly loamy sand.

Permeability is moderate to a depth of about 50 inches and moderately rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

The Crago soil is deep and well drained. It formed in gravelly alluvium derived dominantly from limestone. Typically, the surface layer is light brownish gray gravelly loam about 4 inches thick. The upper 10 inches of the underlying material is light gray gravelly loam, the next 18 inches is white very gravelly sandy loam, and the lower part to a depth of 60 inches or more is light brownish gray extremely gravelly loamy sand.

Permeability is moderate to a depth of about 32 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout. It is droughty because of the high content of coarse fragments and the loamy sand texture of the lower part of the underlying material.

The soils in this unit are used as rangeland, for irrigated crops, and for nonirrigated grass for pasture. The main irrigated crops are alfalfa and grass for hay, grass for pasture, and small grain. This unit is poorly suited to nonirrigated crops because of droughtiness of the Crago soil.

Cropland management. If the soils in this unit are used for cultivated crops, they are limited by droughtiness and the hazards of soil blowing and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the Crago soil is droughty, light and frequent applications of irrigation water are needed. The surface layer of the soils is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility.

If the soils are cultivated, fall plowing should be avoided to minimize soil blowing. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Minimum tillage, contour cultivation, stripcropping, using tall grass barriers and grassed waterways, and returning crop residue to the soil reduce soil blowing and water erosion. Tall grass barriers also reduce evaporation and trap snow, which increases the amount of moisture in the soil. Return of crop residue also helps to maintain good soil tilth. Chiseling stubble fields in fall on the contour or across the slope reduces runoff and water erosion. Leaving crop residue on or near the surface conserves moisture, increases the water intake rate, and improves tilth. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion.

Rangeland management. The potential native plant community on the soils in this unit is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, the soils are also suitable for lilac shrubs and blue spruce trees.

Homesite development. The soils in this unit are suited to homesite development. The Musselshell soil has few limitations. The main limitation of the Crago soil is the rapid permeability of the underlying material. Because the underlying material of the Crago soil is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water. Cutbanks on the soils in this unit are not stable and are subject to slumping.

This map unit is in capability subclass IVe,

nonirrigated and irrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

86—Neen silty clay loam, 0 to 2 percent slopes. This deep, somewhat poorly drained, salt-affected soil is on stream terraces and in upland swales in the western part of the survey area. It formed in loamy alluvium. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of wet alluvial soils dissected by meandering streams and soils that have gravelly and sandy material at a depth of 20 to 40 inches. Also included are a few small areas of well drained soils that are 2 to 4 feet above the main terrace. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Neen soil is mainly light gray silty clay loam about 9 inches thick. The underlying material to a depth of 60 inches or more is light gray silty clay loam.

Permeability is moderately slow. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table is at a depth of 24 to 42 inches in April through August. Where this soil is adjacent to irrigated areas, the water table fluctuates between depths of 12 and 24 inches. This soil is subject to rare, brief periods of flooding during January through June. This soil is calcareous throughout. It is moderately salt-affected throughout.

This unit is used as rangeland. It is poorly suited to cultivated crops because of the content of salt and the seasonal high water table. If a drainage and irrigation system can be developed, the salts can be leached from the soil, making it suitable for irrigated crops. The use of barnyard manure, green manure crops, and commercial fertilizer aids in reclamation.

Rangeland management. The potential native plant community is mainly basin wildrye, alkali sacaton, alkali cordgrass, western wheatgrass, inland saltgrass, alkali bluegrass, and greasewood. If the rangeland is overgrazed, the proportion of basin wildrye, alkali sacaton, alkali cordgrass, and alkali bluegrass decreases and the proportion of western wheatgrass, inland saltgrass, and greasewood increases. If overgrazing continues, plants such as foxtail barley, belvedere summercypress, rubber rabbitbrush, and Canada thistle may invade. The potential native plant community produces about 3,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,100 pounds in years of below-normal precipitation.

Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. In places, brush control improves production of desirable forage plants. This unit is not suited to seeding because of the high content of salts, which reduces seedling survival.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by the high content of salts.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding and the seasonal high water table, which may cause effluent from septic tank absorption fields to contaminate ground water.

This map unit is in capability subclass VIw, nonirrigated. It is in Saline Lowland range site, 10- to 14-inch precipitation zone.

87—Neen silty clay loam, drained, 0 to 2 percent slopes. This deep soil is on stream terraces in the western part of the survey area. It is drained and leached of salts. It formed in loamy alluvium. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Scravo soils and soils that have gravelly and sandy material at a depth of 20 to 40 inches. Also included are small areas of wet soils in swales. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Neen soil is light gray silty clay loam 7 inches thick. The underlying material to a depth of 60 inches or more is light gray silty clay loam.

Permeability is moderately slow. Available water capacity is about 10 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table is at a depth of 48 to 72 inches in April through August. This soil is subject to rare, brief periods of flooding during January through June. The soil is calcareous throughout. It is very slightly or slightly salt-affected.

This unit is used as irrigated cropland. The main crops are small grain, alfalfa, and clover for hay, and grass for pasture.

Cropland management. This unit is limited for irrigated crops by the hazard of soil blowing, the seasonal high water table, salinity, and soil tilth. Excess salts generally can be leached from the soil with irrigation. Good irrigation water management is necessary to avoid application of too much water and to keep the root zone free of salts. Sprinkler irrigation is suitable for the controlled application of water. Salt-tolerant crops should be grown in the initial stages of reclamation. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Growing grasses and legumes for hay and pasture reduces soil blowing. Maintaining crop residue on or near the surface reduces soil blowing and helps to maintain soil tilth and organic matter content.

Windbreak management. This unit is suited to windbreaks. The seasonal high water table limits the choice of trees and shrubs to those that are water tolerant. Suitable trees for planting are cottonwood, golden willow, white willow, Russian olive, Siberian elm, Siberian crabapple, blue spruce, and Rocky Mountain juniper. Suitable shrubs are purpleosier willow, common chokecherry, lilac, and silver buffaloberry.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding and the seasonal high water table.

This map unit is in capability subclass IVe, irrigated.

88—Neen silty clay loam, wet, 0 to 2 percent slopes. This deep, somewhat poorly drained, salt-affected soil is in swales on stream terraces in the western part of the survey area. It has a wetness problem associated with excess irrigation. It formed in loamy alluvium. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Villy soils and soils that have a layer of organic material 4 to 20 inches thick on the surface. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Neen soil is light gray silty clay loam about 9 inches thick. The underlying material to a depth of 60 inches or more is light gray silty clay loam.

Permeability is moderately slow. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. A seasonal high water table is at a depth of 6 to 12 inches from April through August. This soil is subject to occasional, brief periods of flooding from January through June. The soil is calcareous throughout. It is moderately salt-affected throughout the soil profile.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of the seasonal high water table and the problem of salts in the surface layer.

Rangeland management. The potential native plant community is mainly alkali sacaton, sedges, alkali cordgrass, tufted hairgrass, inland saltgrass, alkali bluegrass, American sloughgrass, and northern reedgrass. If the rangeland is overgrazed, the proportion of alkali sacaton, alkali cordgrass, tufted hairgrass, alkali bluegrass, American sloughgrass, and northern reedgrass decreases and the proportion of inland saltgrass, slough sedge, and beaked sedges increases. If overgrazing continues, plants such as foxtail barley, Baltic rush, and annual forbs may invade. The potential native plant community produces about 4,500 pounds of air-dry vegetation per acre in years of above-normal precipitation and 3,800 pounds in years of below-normal precipitation.

Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Use of mechanical treatment is not practical because of wetness and the high content of salts in the soil.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited by the seasonal high water table and the high content of salts.

Homesite development. This unit is very poorly suited to homesite development because of the occasional periods of flooding and the seasonal high water table.

This map unit is in capability subclass VIw, nonirrigated. It is in Wet Meadow range site, 10- to 14-inch precipitation zone.

89—Nuley sandy loam, 2 to 12 percent slopes. This deep, well drained soil is on hills and broad ridgetops in the northwestern and central parts of the survey area. It formed in gneiss. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Rock outcrop and soils that have bedrock at a

depth of less than 40 inches. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Nuley soil is grayish brown sandy loam 7 inches thick. The subsoil is brown sandy clay loam about 4 inches thick. The upper 13 inches of the substratum is white sandy loam, and the lower part to a depth of 42 inches is very pale brown gravelly coarse sand. Granitic gneiss is at a depth of 42 inches. In a few areas west of Harrison and Norris, the surface layer is loam. Bedrock is at a depth of 40 to 60 inches.

Permeability is moderate to a depth of about 24 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 40 to 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used mainly as rangeland. It is also used for nonirrigated pasture.

Cropland management. This unit is poorly suited to nonirrigated small grain. If the unit is used for nonirrigated crops, it is limited mainly by droughtiness and the low available water capacity. This unit is suited to irrigated hay and small grain. It is limited mainly by droughtiness, runoff, and the hazards of soil blowing and water erosion. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, needleandthread, prairie sandreed, Indian ricegrass, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, Indian ricegrass, and prairie sandreed decreases and the proportion of needleandthread, thickspike wheatgrass, threadleaf sedge, prairie junegrass, blue grama, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is poorly suited to windbreaks. It has very limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. The main limitation for homesite development on this unit is the depth to bedrock. Fractures in the bedrock allow effluent to percolate through the bedrock to ground water supplies. Increasing the size of the absorption area may reduce such percolation.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Sandy range site, 10- to 14-inch precipitation zone.

90—Nuley clay loam, 2 to 8 percent slopes. This deep, well drained soil is on hills and broad ridgetops in the northern and western parts of the survey area. It formed in granitic gneiss. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of soils that have a loam, sandy loam, or gravelly surface layer. Also included, mainly on hilltops, are small areas of Rock outcrop and soils that have bedrock at a depth of less than 40 inches. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Nuley soil is grayish brown clay loam 7 inches thick. The subsoil is brown clay loam and light gray sandy clay loam 8 inches thick. The upper 9 inches of the substratum is white sandy loam, and the lower part to a depth of 50 inches is grayish brown gravelly coarse sand. Granitic gneiss is at a depth of 50 inches. Bedrock is at a depth of 40 to 60 inches.

Permeability is moderate to a depth of about 24 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 40 to 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland and for pasture. The main irrigated crops are small grain, alfalfa for hay, and grass and legumes for pasture. The main nonirrigated crops are small grain and grass for pasture.

Cropland management. If this unit is used for cultivated crops, it is limited by droughtiness, runoff, and the hazards of water erosion and soil blowing. Leaving crop residue on or near the surface conserves moisture, increases the water intake rate, and improves tilth. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, needleandthread, winterfat, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition.

Windbreak management. If this unit is used for windbreaks, the low available water capacity limits the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. The main limitation for homesite development on this unit is the depth to bedrock. Fractures in the bedrock allow effluent to percolate through the bedrock to ground water supplies. Increasing the size of the absorption area may reduce such percolation.

This map unit is in capability subclass IIIe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

91—Nuley-Rock outcrop complex, 8 to 35 percent slopes. This map unit is on hills and ridges throughout the survey area. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 65 percent Nuley sandy loam and 20 percent Rock outcrop. Rock outcrop occurs mainly as many small areas scattered throughout the unit, but some areas are as large as 2 to 5 acres.

Included in this unit are small, randomly distributed areas of soils that have bedrock at a depth of less than 40 inches. Also included are small areas of soils that have a thick surface layer. These soils are on foot slopes and in small depressional areas. Included areas make up about 15 percent of the total acreage.

The Nuley soil is deep and well drained. It formed in gneiss. Typically, the surface layer is grayish brown sandy loam about 4 inches thick. The subsoil is brown sandy clay loam about 7 inches thick. The upper 13 inches of the substratum is white sandy loam, and the lower part to a depth of 42 inches is very pale brown gravelly coarse sand. Granitic gneiss is at a depth of 42 inches. Bedrock is at a depth of 40 to 60 inches.

Permeability of the Nuley soil is moderate to a depth of about 24 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 40 to 60 inches. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Rock outcrop is exposures of hard gneiss.

The Nuley soil in this unit is used as rangeland. The unit is very poorly suited to cultivated crops because of the areas of Rock outcrop and the steepness of slope.

Rangeland management. The potential native plant community on the Nuley soil is mainly bluebunch wheatgrass, needleandthread, prairie sandreed, Indian ricegrass, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, Indian ricegrass, and prairie sandreed decreases and the proportion of needleandthread, thickspike wheatgrass, threadleaf sedge, prairie junegrass, blue grama, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant

community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

This unit is poorly suited to seeding because of the areas of Rock outcrop and the steepness of slope.

Windbreak management. This unit is very poorly suited to windbreaks because of the areas of Rock outcrop and the steepness of slope.

Homesite development. If the Nuley soil is used for homesite development, it is limited mainly by slope and the depth to bedrock. The areas of Rock outcrop make road construction difficult and limit accessibility to some areas. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads. Fractures in the bedrock allow effluent to percolate through the bedrock to ground water supplies. Increasing the size of the absorption area may reduce such percolation. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Effluent from absorption fields can surface in downslope areas and create a hazard to health.

This map unit is in capability subclass VIe, nonirrigated. It is in Sandy range site, 10- to 14-inch precipitation zone.

92—Oro Fino loam, 2 to 12 percent slopes. This deep, well drained soil is on gently rolling hills in the northern and western parts of the survey area. It formed in residuum and colluvium derived dominantly from gneiss and schist. Elevation is mainly 6,000 to 6,500 feet, but is as little as 5,200 feet in some areas in the Pony-Harrison area. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free season is about 85 days.

Included in this unit are small, randomly distributed areas of Rock outcrop and soils that have bedrock at a depth of less than 20 inches. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Oro Fino soil is grayish brown loam about 10 inches thick. The subsoil is brown gravelly sandy clay loam about 12 inches thick. The upper 20 inches of the substratum is light gray gravelly loam, and the lower part to a depth of 60 inches or more is brown very gravelly loamy sand.

Permeability is moderate to a depth of about 42 inches and moderately rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly for irrigated and nonirrigated hay and pasture and as rangeland.

Cropland management. The main limitation of this unit for irrigated and nonirrigated hay and pasture is the short growing season. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. The soil in this unit is suited to mechanical practices such as scalping, pitting, furrowing, and chiseling to improve areas of deteriorated rangeland. In places brush management improves production of desirable forage plants.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclasses VIe, irrigated, and IVe, nonirrigated. It is in Silty range site,

15- to 19-inch precipitation zone.

93—Oro Fino-Poin complex, 4 to 15 percent slopes. This map unit is on hills and ridges throughout the survey area. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is 70 percent Oro Fino gravelly loam and 25 percent Poin very flaggy sandy loam. The Oro Fino soil is on hillsides and foot slopes, and the Poin soil is on hilltops and ridges.

Included in this unit is about 5 percent scattered areas of Rock outcrop, mainly on ridgetops.

The Oro Fino soil is deep and well drained. It formed in residuum and colluvium derived dominantly from gneiss and schist. Typically, the surface layer is dark grayish brown gravelly loam about 10 inches thick. The subsoil is brown gravelly sandy clay loam about 12 inches thick. The upper 12 inches of the substratum is light gray gravelly loam, the next 8 inches is pale brown very gravelly sandy loam, and the lower part to a depth of 60 inches or more is brown very gravelly loamy sand.

Permeability is moderate to a depth of about 42 inches and moderately rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Poin soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from gneiss and schist. Typically, the surface layer is grayish brown very flaggy sandy loam about 5 inches thick. The subsoil is brown and pale brown extremely channery sandy loam about 14 inches thick. Fractured bedrock is at a depth of about 19 inches. Depth to bedrock is 10 to 20 inches.

Permeability is moderately rapid. Available water capacity is about 1 inch. Effective rooting depth is about 19 inches. Where this soil is under native vegetation, the average annual wetting depth is about 19 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The soils in this unit are used as rangeland. They are poorly suited to cultivated crops because of droughtiness of the Poin soil and the short growing season.

Rangeland management. The potential native plant community on the Oro Fino soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential native plant community on the Poin soil is mainly bluebunch wheatgrass, Columbia needlegrass, Idaho fescue, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Columbia needlegrass decreases and the proportion of Idaho fescue, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush increases. If overgrazing continues, plants such as onespike danthonia, broom snakeweed, rubber rabbitbrush, annual bromes, and annual forbs may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

In places, brush management improves production of desirable forage plants. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. Rock fragments in the surface layer cause rapid wear of tillage equipment.

Windbreak management. The Oro Fino soil is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this soil is also suited to cottonwood and golden willow trees.

The Poin soil is very poorly suited to windbreaks. It is limited mainly by droughtiness and the very flaggy surface layer.

Homesite development. The main limitation for homesite development on the Oro Fino soil is slope. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

The main limitation for homesite development on the Poin soil is the depth to bedrock. Deep cuts needed to

provide nearly level road surfaces can expose hard bedrock that is difficult to excavate. This soil is severely limited for septic tank filter fields because of the shallow depth to bedrock.

This map unit is in capability subclass VIe, nonirrigated. The Oro Fino soil is in Silty range site, 15- to 19-inch precipitation zone, and the Poin soil is in Shallow range site, 15- to 19-inch precipitation zone.

94—Oro Fino-Poin complex, 15 to 45 percent slopes. This map unit is on hills and ridges throughout the survey area. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is 50 percent Oro Fino gravelly loam and 30 percent Poin very flaggy sandy loam. The Oro Fino soils are on hillsides and foot slopes, and the Poin soils are on hilltops and ridges.

Included in this unit are small areas of Rock outcrop and Adel soils. The areas of Rock outcrop are mainly on ridgetops. The Adel soils are in small depressional areas on north-facing slopes. Included areas make up about 20 percent of the total acreage.

The Oro Fino soil is deep and well drained. It formed in colluvium derived dominantly from gneiss and schist. Typically, the surface layer is dark grayish brown gravelly loam about 10 inches thick. The subsoil is brown gravelly sandy clay loam about 12 inches thick. The upper 12 inches of the substratum is light gray gravelly loam, the next 8 inches is brown very gravelly sandy loam, and the lower part to a depth of 60 inches or more is brown very gravelly loamy sand.

Permeability is moderate to a depth of about 42 inches and moderately rapid below this depth. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Poin soil is shallow and well drained. It formed in colluvium derived dominantly from gneiss and schist. Typically, the surface layer is grayish brown very flaggy sandy loam about 5 inches thick. The subsoil is brown and pale brown extremely channery sandy loam about 14 inches thick. Fractured bedrock is at a depth of about 19 inches. Depth to bedrock is 10 to 20 inches.

Permeability is moderately rapid. Available water capacity is about 1 inch. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of slope and the short growing season.

Rangeland management. The potential native plant community on the Oro Fino soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential native plant community on the Poin soil is mainly bluebunch wheatgrass, Columbia needlegrass, Idaho fescue, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Columbia needlegrass decreases and the proportion of Idaho fescue, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush increases. If overgrazing continues, plants such as onespike danthonia, broom snakeweed, rubber rabbitbrush, annual bromes, and annual forbs may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

In places, brush management improves production of desirable forage plants. Use of mechanical treatment practices is not practical. The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. The soils in this unit are very poorly suited to windbreaks because of the steepness of slope and areas of Rock outcrop.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope and the shallow depth to bedrock in the Poin soil. The included areas of Rock outcrop make road construction difficult and limit accessibility to some areas. Deep cuts needed to provide nearly level road surfaces can expose hard bedrock that is difficult to excavate.

This map unit is in capability subclass VIIe, nonirrigated. The Oro Fino soil is in Silty range site, 15- to 19-inch precipitation zone, and the Poin soil is in Shallow range site, 15- to 19-inch precipitation zone.

95—Pensore-Crago, cool-Rock outcrop complex, 25 to 75 percent slopes. This map unit is on hills in the Madison and Ruby Valleys. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days. Where this unit is mapped in the north end of the Tobacco Root Mountains, the precipitation is higher than is typical for these soils. The plant communities may vary in composition in this area, and the production is greater than that shown in the "Rangeland management" section of this map unit description.

This unit is about 40 percent Pensore very channery loam, 30 percent Crago very stony loam, and 25 percent Rock outcrop. The steep and very steep Pensore soil is on hillsides and ridges, the steep Crago soil is on foot slopes and in drainageways, and the Rock outcrop is on ridgetops and very steep hillsides.

Included in this unit is about 5 percent soils that have slopes of less than 25 percent. These soils are on small shelves and fans and along intermittent drainageways.

The Pensore soil is shallow and well drained. It formed in material derived from limestone. Typically, the surface layer is light brownish gray very channery loam 4 inches thick. The underlying material to a depth of 16 inches is light gray very channery loam. Fractured limestone is at a depth of 16 inches. Depth to fractured limestone is 10 to 20 inches.

Permeability is moderate. Available water capacity is less than 2 inches. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. The soil is calcareous throughout.

The Crago soil is deep and well drained. It formed in cobbly and stony alluvium derived dominantly from limestone. Typically, the surface layer is light brownish gray very stony loam about 4 inches thick. The upper 11 inches of the underlying material is pale brown very stony loam, and the lower part to a depth of 60 inches or more is light gray very cobbly sandy loam.

Permeability is moderate to a depth of about 15 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. The soil is calcareous throughout.

The areas of Rock outcrop consist of hard, fractured limestone in the form of ridges, cliffs, and small shelves.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the steepness of slope, the areas of Rock outcrop, and the very stony surface layer of the Crago soil.

Rangeland management. The potential native plant community on the Pensore soil is mainly bluebunch wheatgrass, needleandthread, antelope bitterbrush, and curlleaf mountainmahogany. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, Sandberg bluegrass, blue grama, threadleaf sedge, antelope bitterbrush, and curlleaf mountainmahogany increases. If overgrazing continues, plants such as annual bromes, rubber rabbitbrush, and broom snakeweed may invade. The potential native plant community produces about 1,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 600 pounds in years of below-normal precipitation.

The potential native plant community on the Crago soil is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Use of mechanical treatment practices is not practical. Steepness of slope and the areas of Rock outcrop limit access by livestock. The Pensore and Crago soils are limited for livestock watering ponds and other impoundments because of the potential for seepage. Reservoirs need to be lined to prevent excessive seepage.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope.

Homesite development. This unit is very poorly suited to homesite development because of steepness of slope, the shallow depth to bedrock in the Pensore soil, and the areas of Rock outcrop.

This map unit is in capability subclass VIIe, nonirrigated. The Pensore soil is in Shallow range site, 10- to 14-inch precipitation zone, and the Crago soil is in Thin Silty range site, 10- to 14-inch precipitation zone.

96—Pits, gravel. This map unit is mainly on fans and terraces in the intermontane valleys of the survey area. It formed in extremely gravelly and cobbly alluvium. Slopes range from nearly level to very steep. Areas of this map unit generally are less than 20 acres in size. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free season is about 100 days.

This unit is used as a source of gravel.

The original vegetation on this unit has been disturbed by excavation. Reestablishment of vegetation is limited by the droughtiness of the extremely gravelly and cobbly soil material and the periodic disturbance by man.

This map unit is in capability subclass VIIIs, nonirrigated.

97—Poin-Earcree, dry, complex, 45 to 60 percent slopes. This map unit is on hillsides in the northeastern part of the survey area. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 19 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 60 percent Poin very flaggy sandy loam and 20 percent Earcree gravelly sandy loam. The Poin soil is on hillsides and ridges, and the Earcree soil is on foot slopes and in drainageways.

Included in this unit are small areas of Sebud and Oro Fino soils and Rock outcrop. The Sebud and Oro Fino soils occur randomly throughout the unit on small ledges and foot slopes. The Rock outcrop is mainly on ridges. Included areas make up about 20 percent of the total acreage.

The Poin soil is shallow and well drained. It formed in colluvium derived from gneiss and sandstone. Typically, the surface layer is grayish brown very flaggy sandy loam about 7 inches thick. The subsoil is pale brown extremely flaggy sandy loam about 7 inches thick. Fractured bedrock is at a depth of 14 inches. Depth to bedrock is 10 to 20 inches.

Permeability of the Poin soil is moderately rapid. Available water capacity is about 1 inch. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Earcree soil is deep and well drained. It formed in alluvium derived from gneiss, schist, and sandstone. Typically, the surface layer is gray gravelly sandy loam about 28 inches thick. The subsoil to a depth of 60 inches or more is pale brown gravelly sandy loam.

Permeability of the Earcree soil is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the steepness of slope and the short growing season.

Rangeland management. The potential native plant community on the Poin soil is mainly bluebunch wheatgrass, Idaho fescue, Columbia needlegrass, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Columbia needlegrass decreases and the proportion of Idaho fescue, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush increases. If overgrazing continues, plants such as onespike danthonia, broom snakeweed, rubber rabbitbrush, annual bromes, and annual forbs may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The potential native plant community on the Earcree soil is mainly bluebunch wheatgrass, basin wildrye, mountain brome, Richardson needlegrass, Columbia needlegrass, and Idaho fescue. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, basin wildrye, mountain brome, Richardson needlegrass, and Columbia needlegrass decreases and the proportion of Idaho fescue, big sagebrush, hairy goldenaster, thickspike wheatgrass, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,700 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical. The surface layer of the soils in this unit is susceptible to

water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. In places, brush control improves production of desirable forage plants. Steepness of slope limits access by livestock.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope and the shallow depth to bedrock in the Poin soil.

This map unit is in capability subclass VIIe, nonirrigated. The Poin soil is in Shallow range site, 15- to 19-inch precipitation zone, and the Earcree soil is in Thin Sandy range site, 15- to 19-inch precipitation zone.

98—Poin-Rock outcrop complex, 4 to 15 percent slopes. This map unit is is on ridges in the southern part of the survey area. Elevation is 6,900 to 7,500 feet. The average annual precipitation is about 19 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 60 percent Poin very flaggy sandy loam and 20 percent Rock outcrop.

Included in this unit are small, randomly distributed areas of Libeg and Sebud soils. Also included are small areas of soils that have a very stony surface layer. Included areas make up about 20 percent of the total acreage.

The Poin soil is shallow and well drained. It formed in residuum derived from rhyolite, gneiss, and welded tuff. Typically, the surface layer is grayish brown very flaggy sandy loam about 5 inches thick. The upper 7 inches of the subsoil is brown very channery sandy loam, and the lower 7 inches is pale brown extremely channery sandy loam. Fractured bedrock is at a depth of 19 inches.

Permeability is moderately rapid. Available water capacity is about 1.5 inches. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. Bedrock is at a depth of 10 to 20 inches.

The Rock outcrop is on ledges and points and in low-lying, wind-scoured spots. It consists of quartz, gneiss, rhyolite, and welded tuff.

This unit is used as rangeland. It is not suited to cultivated crops because of the shallow depth to bedrock, the areas of Rock outcrop, and the short growing season.

Rangeland management. The potential native plant community on the Poin soil is mainly bluebunch wheatgrass, Columbia needlegrass, Idaho fescue, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Columbia needlegrass decreases and the proportion of Idaho fescue, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush increases. If overgrazing continues, plants such as onespike danthonia, broom snakeweed, rubber rabbitbrush, annual bromes, and annual forbs may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical. This unit is not suited to seeding because of the areas of Rock outcrop and the shallow depth to bedrock in the Poin soil.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by droughtiness, the very flaggy surface layer of the Poin soil, and the areas of Rock outcrop.

Homesite development. This unit is poorly suited to homesite development because of the shallow depth to bedrock in the Poin soil and the areas of Rock outcrop. These limitations severely restrict most urban development.

This map unit is in capability subclass VIIs, nonirrigated. It is in Shallow range site, 15- to 19-inch precipitation zone.

99—Poin-Sebud complex, 8 to 45 percent slopes. This map unit is on smooth, broad hills in the northeastern part of the survey area. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 19 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 40 percent Poin very flaggy sandy loam and 40 percent Sebud very channery sandy loam. The Poin soil is mainly on the tops and sides of hills, and the Sebud soil is on hillsides and foot slopes.

Included in this unit are small areas of Adel and Earcree soils, Rock outcrop, and very stony soils. The Adel and Earcree soils are in drainageways and swales. The Rock outcrop and very stony soils are on ridges and knolls. Also included are small areas of Poin and Sebud soils that have slopes of more than 45 percent. Included areas make up about 20 percent of the total acreage.

The Poin soil is shallow and well drained. It formed in residuum and colluvium derived from gneiss and

sandstone. Typically, the surface layer is grayish brown very flaggy sandy loam about 7 inches thick. The subsoil is pale brown extremely flaggy sandy loam about 7 inches thick. Fractured bedrock is at a depth of 14 inches. Depth to bedrock is 10 to 20 inches.

Permeability of the Poin soil is moderately rapid. Available water capacity is about 1 inch. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Sebud soil is deep and well drained. It formed in colluvium derived from gneiss. Typically, the surface layer is brown very channery sandy loam about 14 inches thick. The subsoil is yellowish brown very stony sandy loam about 32 inches thick. The substratum to a depth of 60 inches or more is very pale brown very stony coarse sandy loam.

Permeability of the Sebud soil is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the steepness of slope and the short growing season.

Rangeland management. The potential native plant community on the Poin soil is mainly bluebunch wheatgrass, Idaho fescue, Columbia needlegrass, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Columbia needlegrass decreases and the proportion of Idaho fescue, needleandthread, threadleaf sedge, lupine, Wyoming big sagebrush, and black sagebrush increases. If overgrazing continues, plants such as clubmoss, onespike danthonia, broom snakeweed, rubber rabbitbrush, annual bromes, and annual forbs may invade. The potential native plant community produces about 1,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The potential native plant community on the Sebud soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical. The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope and by the droughtiness of the Poin soil.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope and the shallow depth to bedrock in the Poin soil.

This map unit is in capability subclass VIIe, nonirrigated. The Poin soil is in Shallow range site, 15- to 19-inch precipitation zone, and the Sebud soil is in Silty range site, 15- to 19-inch precipitation zone.

100—Raynesford loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and foot slopes in the northeastern part of the survey area. It formed in alluvium and colluvium derived dominantly from limestone. Elevation is 5,000 to 7,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Hanson soils and deep, dark-colored soils. The Hanson soils are in the steeper areas on fans and foot slopes. The deep, dark-colored soils are in swales and in some low lying drainageways. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Raynesford soil is very dark gray loam about 16 inches thick. The upper 4 inches of the underlying material is light gray gravelly silt loam, and the lower part to a depth of 60 inches or more is white gravelly silty clay loam.

Permeability is moderately slow. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is suited to irrigated and nonirrigated pasture and hay. It has few limitations. The unit is poorly suited to other cultivated crops

because of the short growing season, runoff, and the hazards of water erosion and soil blowing.

Rangeland management. The potential native plant community is mainly mountain brome, Richardson needlegrass, basin wildrye, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition. This unit is suited to mechanical practices such as scalping, pitting, chiseling, and furrowing to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by the moderately slow permeability. If the soil in this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

101—Redchief Variant-Hapgood, moist, complex, 8 to 25 percent slopes. This map unit is on rolling hills and foot slopes. It is in Centennial Valley, in the southeastern part of the survey area. Elevation is 7,000 to 7,500 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is 50 percent Redchief Variant loam and 40 percent Hapgood gravelly loam. The Redchief Variant soil is on hilltops and hillsides, and the Hapgood soil is in swales and at the base of hills.

Included in this unit are small areas of Bridger, Libeg, and Earcree soils. The Bridger soils are on flat ridges and hilltops. The Libeg soils are on narrow ridges and points. The Earcree soils are on south- and southwest-facing slopes and in swales where windblown sand has been deposited. Also included are small areas of soils that have slopes of 2 to 8 percent. Included areas make up about 10 percent of the total acreage.

The Redchief Variant soil is deep and well drained. It formed in alluvium and glacial drift derived from igneous rock. Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is dark brown gravelly loam about 6 inches thick. The upper 8 inches of the subsoil is pale brown cobbly sandy clay loam, and the lower 25 inches is brown very gravelly clay. The substratum to a depth of 60 inches or more is light brownish gray very gravelly clay loam.

Permeability is slow. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Hapgood soil is deep and well drained. It formed in colluvium and glacial till derived mainly from igneous rock. Typically, the surface layer is dark gray gravelly loam about 22 inches thick. The subsoil is dark brown very gravelly clay loam about 18 inches thick. The substratum to a depth of 60 inches or more is light brownish gray very gravelly clay loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are poorly suited to cultivated crops because of the short growing season and steepness of slope.

Rangeland management. The potential native plant community on the soils in this unit is mainly basin wildrye, Columbia needlegrass, spike fescue, rough fescue, mountain brome, Richardson needlegrass, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Columbia needlegrass, spike fescue, rough fescue, mountain brome, and Richardson needlegrass decreases and the proportion of Idaho fescue, timber

danthonia, Canby bluegrass, lupine, and mountain big sagebrush increases. If overgrazing continues, plants such as Canada bluegrass, Kentucky bluegrass, timothy, onespike danthonia, and annual forbs may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. The less sloping areas are suited to reseeding of native or adapted introduced forage species. The soils in this unit are suited to mechanical practices such as scalping, pitting, and chiseling to improve areas of deteriorated rangeland.

Windbreak management. This unit is very poorly suited to windbreaks. The main limitation is steepness of slope.

Homesite development. The main limitations for homesite development on the soils in this unit are slope, slow permeability of the Redchief Variant soil, and moderate permeability of the Hapgood soil. The Redchief Variant soil is also limited by shrink-swell potential and low soil strength. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. If the soils in this unit are used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. In the construction of basements or foundations for dwellings, the limitation of shrink-swell potential can be overcome by backfilling excavations with suitable material that has low shrink-swell potential. Shrinking and swelling and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty range site, 20- to 24-inch precipitation zone.

102—Rentsac very channery loam, 45 to 75 percent slopes. This shallow, well drained soil is on hills and ridges in the northern and western parts of the survey area. It formed in colluvium derived dominantly from basalt. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of deep loamy soils. Also included are small, nearly barren areas of Rock outcrop and rock talus. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Rentsac soil is grayish brown very channery loam about 4 inches thick. The underlying material to a depth of about 16 inches is light brownish gray very channery loam. Fractured basalt is at a depth of 16 inches. Depth to basalt is 10 to 20 inches.

Permeability is moderately rapid. Available water capacity is about 1 inch. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 16 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is poorly suited to cultivated crops because of steepness of slope and droughtiness.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, needleandthread, antelope bitterbrush, and curlleaf mountainmahogany. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, Sandberg bluegrass, blue grama, threadleaf sedge, antelope bitterbrush, and curlleaf mountainmahogany increases. If overgrazing continues, plants such as annual bromes, rubber rabbitbrush, and broom snakeweed may invade. The potential native plant community produces about 1,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 600 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock. Use of mechanical treatment is not practical.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. This unit is poorly suited to homesite development because of steepness of slope and the shallow depth to bedrock.

This map unit is in capability subclass VIIe, nonirrigated. It is in Shallow range site, 10- to 14-inch precipitation zone.

103—Rentsac-Kalsted complex, 8 to 25 percent slopes. This map unit is on dissected hills in the northwestern part of the survey area. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about

40 degrees F, and the average frost-free period is about 100 days.

This unit is about 40 percent Rentsac channery sandy loam and 40 percent Kalsted sandy loam. The Rentsac soil is on ridges and side slopes, and the Kalsted soil is on foot slopes and in swales.

Included in this unit are a few small areas of Rock outcrop, Varney soils, and moderately deep soils. The Rock outcrop is on ridgetops and is scattered throughout the unit. The moderately deep soils and the Varney soils are mainly on foot slopes. Included areas make up about 20 percent of the total acreage.

The Rentsac soil is shallow and well drained. It formed in material derived from calcareous sandstone and gneiss and schist. Typically, the surface layer is grayish brown channery sandy loam about 4 inches thick. The underlying material to a depth of about 16 inches is light brownish gray very channery sandy loam. Fractured gneiss and schist are at a depth of 16 inches. Depth to bedrock is 10 to 20 inches.

Permeability is moderately rapid. Available water capacity is about 1 inch. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 16 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Kalsted soil is deep and well drained. It formed in calcareous alluvium and in eolian material. Typically, the surface layer is gray sandy loam about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray sandy loam.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the droughtiness of the Rentsac soil and slope.

Rangeland management. The potential native plant community on the Rentsac soil is mainly bluebunch wheatgrass, needleandthread, antelope bitterbrush, and curlleaf mountainmahogany. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, Sandberg bluegrass, blue grama, threadleaf sedge, antelope bitterbrush, and curlleaf mountainmahogany increases. If overgrazing continues, plants such as annual bromes, rubber rabbitbrush, and brome snakeweed may invade. The potential native plant community produces about 1,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 600 pounds in years of below-normal precipitation.

The potential native plant community on the Kalsted soil is mainly bluebunch wheatgrass, Indian ricegrass, prairie sandreed, needleandthread, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, Indian ricegrass, and prairie sandreed decreases and the proportion of needleandthread, threadleaf sedge, prairie junegrass, blue grama, thickspike wheatgrass, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, fringed sagewort, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Use of mechanical practices is not practical because of the rough and broken topography, steepness of slope, and the very low available water capacity of the Rentsac soil.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope and the droughtiness of the Rentsac soil.

Homesite development. The Rentsac soil is poorly suited to homesite development because of the steepness of slope and the shallow depth to bedrock. The Kalsted soil is limited mainly by slope. Homesites should be located only in areas of the Kalsted soil. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIIe, nonirrigated. The Rentsac soil is in Shallow range site, 10- to 14-inch precipitation zone, and the Kalsted soil is in Sandy range site, 10- to 14-inch precipitation zone.

104—Rentsac-Varney complex, 8 to 45 percent slopes. This map unit is on dissected hills in the western and northern parts of the survey area. Elevation is 4,500 to 6,500 feet. The average annual

precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 50 percent Rentsac channery loam and 30 percent Varney gravelly clay loam. The moderately steep and steep Rentsac soil is on ridges and hillsides, and the strongly sloping and moderately steep Varney soil is on foot slopes and fans.

Included in this unit are small areas of Varney clay loam and Rock outcrop. The Rock outcrop is mainly on hilltops. Included areas make up about 20 percent of the total acreage.

The Rentsac soil is shallow and well drained. It formed in material derived from sandstone. The surface layer is grayish brown channery loam about 4 inches thick. The underlying material to a depth of about 16 inches is light brownish gray very channery loam. Hard fractured sandstone is at a depth of 16 inches. Depth to bedrock is 10 to 20 inches.

Permeability is moderately rapid. Available water capacity is about 1 inch. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 16 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Varney soil is deep and well drained. It formed in alluvium. Typically, the surface layer is dark grayish brown gravelly clay loam about 3 inches thick. The subsoil is brown gravelly clay loam about 8 inches thick. The upper 12 inches of the substratum is white gravelly sandy clay loam, and the lower part to a depth of 60 inches or more is light gray gravelly sandy loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of slope and the very low available water capacity of the Rentsac soil.

Rangeland management. The potential native plant community on the Rentsac soil is mainly bluebunch wheatgrass, needleandthread, antelope bitterbrush, and curlleaf mountainmahogany. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, Sandberg bluegrass, blue grama, threadleaf sedge, antelope bitterbrush, and curlleaf mountainmahogany increases. If overgrazing continues, plants such as annual bromes, rubber rabbitbrush, and broom snakeweed may invade. The potential native plant community produces about 1,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 600 pounds in years of below-normal precipitation.

The potential native plant community on the Varney soil is mainly bluebunch wheatgrass, green needlegrass, needleandthread, winterfat, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock. The soils in this unit are not suitable for mechanical treatment practices because of slope. A few areas of the Varney soil are large enough and have slopes suitable for mechanical treatment.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope and the droughtiness of the Rentsac soil.

Homesite development. The Rentsac soil is poorly suited to homesite development because of steepness of slope and the shallow depth to bedrock. The Varney soil is limited mainly by the moderate permeability, low strength, and the potential for shrinking and swelling. Homesites should be located in areas of the Varney soil. If the Varney soil is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Shrinking and swelling and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIIe, nonirrigated. The Rentsac soil is in Shallow range site, 10- to 14-inch precipitation zone, and the Varney soil is in Thin Silty range site, 10- to 14-inch precipitation zone.

105—Rivra very gravelly sandy loam, cool, 2 to 4 percent slopes. This deep, well drained soil is on fans and low terraces along small perennial and intermittent streams. It formed in mixed alluvium. This soil is subject to rare periods of flooding. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of deep loamy soils and loamy soils that are 20 to 40 inches deep to gravelly and sandy material. Also included are small areas of soils that have a cobbly or stony surface layer. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Rivra soil is light brownish gray very gravelly sandy loam about 12 inches thick. The underlying material to a depth of 60 inches or more is grayish brown extremely gravelly coarse sand. Depth to gravelly and sandy material is 5 to 15 inches.

Permeability is very rapid. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare, brief periods of flooding from ice jams in winter, spring runoff, and torrential rainstorms in summer.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of the rare, brief periods of flooding and the very low available water capacity.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, needleandthread, Indian ricegrass, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, blue grama, Sandberg bluegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, annual bromes, and plains pricklypear may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

This unit is very poorly suited to seeding because of the high content of gravel in the surface layer.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by droughtiness.

Homesite development. The main limitations for homesite development on this unit are the rare, brief periods of flooding and the rapid permeability of the soil. This unit receives overflow from spring runoff and winter ice jams; therefore, buildings should be designed, constructed, and located with this hazard in mind. Because the soil is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIs. It is in Shallow to Gravel range site, 10- to 14-inch precipitation zone.

106—Rivra, cool-Fluvaquents complex, 0 to 2 percent slopes. This map unit is on low terraces in the stream valleys of the survey area. It is subject to frequent periods of flooding in spring and has a seasonal water table. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 40 percent Rivra gravelly sandy loam and 40 percent Fluvaquents.

Included in this unit are a few small, randomly distributed areas of soils that are similar to the Rivra soil but have a loam or sandy loam surface layer and a few areas of Ryell soils. Included areas make up about 20 percent of the total acreage.

The Rivra soil is deep and well drained. It formed in mixed alluvium. Typically, the surface layer is grayish brown gravelly sandy loam about 12 inches thick. The underlying material to a depth of 60 inches or more is grayish brown extremely gravelly sand. Depth to gravelly and sandy material is 5 to 15 inches.

Permeability is very rapid. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table is at a depth of less than 42 inches at some time during spring or early in summer. This soil is subject to frequent periods of flooding between January and June.

Fluvaquents are shallow to moderately deep to sand and gravel and are poorly drained. These soils formed in alluvium derived from mixed rock sources. They are loam, sandy loam, or loamy sand.

Permeability is rapid. Available water capacity is less than 2 inches. Effective rooting depth is 60 inches or more. Where these soils are under native vegetation, the average annual wetting depth is 60 inches or more.

Runoff is slow, and the hazard of water erosion is slight, except during periods of flooding. The hazard of soil blowing is slight. A seasonal high water table is at the surface to a depth of 24 inches in spring or early in summer, but the water table is at a depth of 48 to 72 inches during most of the growing season. These soils are subject to frequent periods of flooding.

The soils in this unit are used as rangeland. They are very poorly suited to cultivated crops because of flooding and the very low available water capacity.

Rangeland management. The potential native plant community on the Rivra soil is mainly bluebunch wheatgrass, needleandthread, Indian ricegrass, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of western wheatgrass, needleandthread, prairie junegrass, blue grama, Sandberg bluegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, annual bromes, and plains pricklypear may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The potential native plant community on the Fluvaquents is mainly slough sedge, tall reedgrass, tufted hairgrass, slender wheatgrass, Nebraska sedge, shrubby cinquefoil, and Douglas hawthorn. If the rangeland is overgrazed, the proportion of tall reedgrass, tufted hairgrass, slender wheatgrass, and Nebraska sedge decreases and the proportion of bluegrasses, shrubby cinquefoil, slough sedge, and Douglas hawthorn increases. If overgrazing continues, plants such as Kentucky bluegrass, Rocky Mountain iris, Baltic rush, and foxtail barley may invade. The potential native plant community produces about 5,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 3,000 pounds in years of below-normal precipitation.

Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on the soils in this unit if the rangeland vegetation is in poor condition.

Windbreak management. This unit is very poorly suited to windbreaks. The Rivra soil is limited mainly by droughtiness, and the Fluvaquents are limited by the seasonal high water table.

Homesite development. This unit is poorly suited to homesite development because of the frequent periods of flooding. Because the soils in this unit are rapidly permeable, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIw. The Rivra soil is in Shallow to Gravel range site, 10- to 14-inch precipitation zone, and the Fluvaquents are in Subirrigated range site, 10- to 14-inch precipitation zone.

107—Rivra-Ryell-Havre complex, cool, 0 to 2 percent slopes. This map unit is on low terraces along major rivers and streams in intermontane valleys. It is subject to rare periods of flooding late in spring. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 40 percent Rivra gravelly sandy loam, 25 percent Ryell loam, and 20 percent Havre loam. The Rivra soil is on higher gravel bars throughout the unit, and the Ryell and Havre soils are scattered throughout the rest of the unit.

Included in this unit are small areas of very poorly drained soils in narrow swales and old stream meander channels. Also included are small areas of Rivra soils that do not have a gravelly surface layer and soils that have a seasonal high water table at a depth of 48 to 72 inches. Included areas make up about 15 percent of the total acreage.

The Rivra soil is deep and well drained. It formed in gravelly alluvium. Typically, the surface layer is grayish brown gravelly sandy loam about 4 inches thick. The subsurface layer is grayish brown extremely gravelly sandy loam 8 inches thick. The substratum to a depth of 60 inches or more is grayish brown extremely gravelly sand. Depth to sand and gravel is 5 to 15 inches.

Permeability is very rapid. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare, brief periods of flooding during unusual weather conditions.

The Ryell soil is deep and well drained. It formed in alluvium. Typically, the surface layer is grayish brown loam about 7 inches thick. The upper 16 inches of the underlying material is light brownish gray silt loam, and the lower part to a depth of 60 inches or more is extremely gravelly loamy sand.

Permeability is moderate to a depth of about 23

inches and rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is calcareous throughout. It is subject to rare, brief periods of flooding during unusual weather conditions.

The Havre soil is deep and well drained. It formed in stratified loamy alluvium. Typically, the surface layer is light brownish gray loam about 9 inches thick. The upper 25 inches of the underlying material is grayish brown and dark gray, stratified loam, fine sandy loam, and clay loam, and the lower part to a depth of 60 inches or more is light gray sandy loam with strata of loam and silt loam.

Permeability is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is subject to rare, brief periods of flooding during unusual weather conditions.

The soils in this unit are used for irrigated hay and pasture and as rangeland. Hay and pasture crops are irrigated by wild flooding.

Rangeland management. The potential native plant community on the Rivra soil is mainly bluebunch wheatgrass, needleandthread, Indian ricegrass, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, blue grama, Sandberg bluegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, annual bromes, and plains pricklypear may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The potential native plant community on the Ryell and Havre soils is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the rangeland vegetation is in poor condition.

Windbreak management. The Rivra soil is very poorly suited to nonirrigated windbreaks. It is limited mainly by droughtiness. If this soil is irrigated, suitable trees for planting are Russian olive, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, skunkbush sumac, and lilac.

The Ryell soil is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this soil is also suited to golden willow, cottonwood, and blue spruce trees and to lilac shrubs.

The Havre soil is well suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this soil is also suited to cottonwood and golden willow trees.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding. Because the substratum of the Rivra and Ryell soils is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIs, nonirrigated and irrigated. The Rivra soil is in the Shallow to Gravel range site, 10- to 14-inch precipitation zone, and the Ryell and Havre soils are in Silty range site, 10- to 14-inch precipitation zone.

108—Rochester-Rock outcrop complex, 35 to 70 percent slopes. This map unit is on mountainsides. Elevation is 6,000 to 7,800 feet. The average annual precipitation is about 22 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 90 days.

This unit is about 60 percent Rochester very stony loamy sand and 25 percent Rock outcrop. The Rochester soil is mainly on south-facing slopes, and the Rock outcrop is on ledges and ridgetops.

Included in this unit are small areas of loamy soils

and soils that have a darker colored surface layer. The loamy soils are on the lower parts of slopes, and the darker colored soils are on foot slopes and in swales. Also included are areas of talus and rubble land that support little or no vegetation. Included areas make up about 15 percent of the total acreage.

The Rochester soil is deep and excessively drained. It formed in colluvium derived from gneiss, schist, and granite. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is dark grayish brown very stony loamy sand about 3 inches thick. The subsoil is pale brown very stony loamy sand about 11 inches thick. The substratum to a depth of 60 inches or more is light brownish gray very stony loamy sand.

Permeability is rapid. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Rock outcrop consists of exposures of gneiss, schist, or granite.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory on the Rochester soil is mainly pinegrass, elk sedge, bluebunch wheatgrass, Idaho fescue, Rocky Mountain juniper, and common snowberry. The potential native understory produces about 300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 100 pounds in years of below-normal precipitation.

Forest management. The Rochester soil is suited to Douglas fir and lodgepole pine. The site index for Douglas fir is 38. The potential annual production (CMAI) per acre is about 50 cubic feet or 150 board feet (Scribner rule). Potential production is for an even-aged, fully stocked stand of trees. Yield estimates for lodgepole pine were not made.

The main limitations for timber management are slope, stones in the surface layer, and the very low available water capacity. Steepness of slope and stones in the surface layer limit the kinds of equipment that can be used. Track-type tractors can be used effectively on most slopes; however, line skidding should be considered for use on the steeper slopes. Understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard on the soils in this unit if they are disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIs, nonirrigated. It is in woodland suitability group 3R.

109—Rock outcrop-Cryoborolls-Cryochrepts complex, very steep. This map unit is on mountains, mainly in the Madison and Snowcrest mountain ranges. Elevation is 8,000 to 11,000 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 34 degrees F, and the average frost-free period is about 45 days.

This unit is about 70 percent Rock outcrop, 15 percent Cryoborolls, and 15 percent Cryochrepts.

The Rock outcrop is mainly exposures of andesite, gneiss, limestone, and conglomerate, but some areas are sandstone, slate, and granite. These areas occur as ledges and talus slopes. In places the rock has been moved considerable distances by water, gravity, and ice. Size of the rock fragments ranges from large boulders to fine angular gravel. The areas of Rock outcrop support little vegetation, except for a few shrubs and trees in fractures.

The Cryoborolls and Cryochrepts are very shallow to deep. The Cryoborolls are mainly a thin organic layer over a brown or reddish brown loamy surface layer and subsoil. Vegetation consists of alpine sedges, grasses, and clover and moss, dryad, common juniper, and mountain heath. The Cryochrepts have a large amount of coarse fragments. They have a pale brown or light gray surface layer. Texture is loamy sand to loam. Vegetation consists mainly of subalpine fir, whitebark pine, spruce, and grouse whortleberry.

The Cryoborolls and Cryochrepts have a high water erosion potential when disturbed because of heavy snowpack and rapid runoff.

This unit is used as wildlife habitat, watershed, and recreation areas.

This map unit is in capability subclass VIIIs, nonirrigated.

110—Ryell-Rivra complex, cool, 0 to 2 percent slopes. This map unit is on low terraces in intermontane valleys. It is subject to rare periods of flooding late in spring. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 60 percent Ryell loam and 20 percent Rivra gravelly sandy loam. The Ryell soils are on low terraces, and the Rivra soils are on the higher sand and gravel bars that are scattered throughout the unit.

Included in this unit are a few small areas of Havre soils, Fluvaquents, and soils that have cobbly surface layer. The Havre soils and Fluvaquents are in swales and old stream meander channels. The cobbly soils are scattered throughout the unit. Also included are a few areas of similar soils that have a seasonal high water table at a depth of 48 to 72 inches. Included areas make up about 20 percent of the total acreage.

The Ryell soil is deep and well drained. It formed in alluvium. Typically, the surface layer is grayish brown loam about 7 inches thick. The upper 16 inches of the underlying material is light brownish gray silt loam, and the lower part to a depth of 60 inches or more is extremely gravelly loamy sand.

Permeability is moderate to a depth of about 23 inches and rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is calcareous throughout. It is subject to brief, rare periods of flooding.

The Rivra soil is deep and well drained. It formed in gravelly alluvium. Typically, the surface layer is brown gravelly sandy loam about 5 inches thick. The upper 4 inches of the underlying material is brown gravelly loamy sand, and the lower part to a depth of 60 inches or more is extremely gravelly coarse sand. Depth to gravelly and sandy material is 5 to 15 inches.

Permeability is very rapid. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to rare, brief periods of flooding.

The soils in this unit are used for irrigated hay and pasture and as rangeland. If this unit is used for nonirrigated crops, it is limited mainly by droughtiness and the low available water capacity.

Cropland management. If the soils in this unit are used for irrigated hay and pasture, they are limited mainly by the rare periods of flooding from April through June and by droughtiness of the Rivra soil. Because the Rivra soil is droughty, light and frequent applications of irrigation water are needed. Sprinkler irrigation is the most suitable method of applying water.

Rangeland management. The potential native plant community on the Ryell soil is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The potential native plant community on the Rivra soil is mainly bluebunch wheatgrass, needleandthread, Indian ricegrass, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, blue grama, Sandberg bluegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, annual bromes, and plains pricklypear may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition.

Windbreak management. The Ryell soil is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this soil is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

The Rivra soil is very poorly suited to nonirrigated windbreaks. It is limited mainly by droughtiness. If irrigated, trees suitable for planting are Russian olive, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, skunkbush sumac, and lilac.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding. Because the substratum of the soils in this unit is rapidly permeable, effluent from septic tank

absorption fields may contaminate ground water.

This map unit is in capability subclass IVe, nonirrigated and irrigated. The Ryell soil is in Silty range site, 10- to 14-inch precipitation zone, and the Rivra soil is in Shallow to Gravel range site, 10- to 14-inch precipitation zone.

111—Ryell-Rivra sandy loams, cool, saline, 0 to 2 percent slopes. This map unit is on low terraces between the Big Hole and Beaverhead Rivers. It is subject to rare periods of flooding late in spring and has a seasonal high water table during the irrigation season. These soils have accumulations of salt throughout the profile as a result of many years of excess irrigation in upstream areas. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 50 percent Ryell sandy loam and 30 percent Rivra sandy loam.

Included in this unit are small, randomly distributed areas of Rivra soils that have a gravelly surface layer. Also included are areas of deep soils that are sandy loam throughout and areas of poorly drained soils in narrow swales and old meander channels. Included areas make up about 15 percent of the total acreage.

The Ryell soil is deep and has a wetness problem associated with excess irrigation. It formed in alluvium. Typically, the surface layer is pale brown sandy loam about 6 inches thick. The upper 22 inches of the underlying material is grayish brown, stratified loam and sandy loam, and the lower part to a depth of 60 inches or more is very gravelly loamy sand.

Permeability of the Ryell soil is moderate to a depth of about 28 inches and rapid below this depth. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table is at a depth of 12 to 36 inches in summer and early in fall. This soil is subject to rare, brief periods of flooding. It is calcareous throughout. It is moderately salt-affected throughout.

The Rivra soil is deep and has a wetness problem associated with excess irrigation. It formed in gravelly alluvium. Typically, the surface layer is light brownish gray sandy loam about 6 inches thick. The upper 7 inches of the underlying material is pale brown, stratified sandy loam and very gravelly sandy loam, and the lower part to a depth of 60 inches or more is very pale brown very gravelly sand. Depth to gravelly and sandy material is 5 to 15 inches.

Permeability of the Rivra soil is very rapid. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table is at a depth of 5 to 20 inches in summer and early in fall. This soil is subject to rare, brief periods of flooding. It is moderately salt-affected throughout. The soil is calcareous throughout.

The soils in this unit are used as rangeland. They are very poorly suited to cultivated crops because of wetness and salinity.

Rangeland management. The potential native plant community on the soils in this unit is mainly basin wildrye, alkali sacaton, alkali cordgrass, western wheatgrass, inland saltgrass, alkali bluegrass, and greasewood. If the rangeland is overgrazed, the proportion of basin wildrye, alkali sacaton, alkali cordgrass, and alkali bluegrass decreases and the proportion of western wheatgrass, inland saltgrass, and greasewood increases. If overgrazing continues, plants such as foxtail barley, belvedere summercypress, rubber rabbitbrush, and Canada thistle may invade. The potential native plant community produces about 3,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,100 pounds in years of below-normal precipitation.

Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. In places, brush control improves production of desirable forage plants. Use of mechanical equipment to improve forage production may be limited by wetness except in fall. Areas near irrigated land are driest late in spring.

Windbreak management. The soils in this unit are very poorly suited to windbreaks because of wetness and salinity.

Homesite development. The soils in this unit are poorly suited to homesite development because of the rare periods of flooding. Because of the seasonal high water table and the very rapidly permeable and rapidly permeable underlying material, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIw, nonirrigated. It is in Saline Lowland range site, 10- to 14-inch precipitation zone.

112—Saunders silty clay loam, 0 to 2 percent slopes. This deep, poorly drained, moderately saline soil is on terraces in the Madison Valley. It formed in

alluvium. Elevation is 4,800 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of very poorly drained soils in old stream meander channels that are 5 to 20 feet in width and several feet lower than the main terraces. Also included are small areas of soils that are frequently flooded because of ice jams and soils on mounds that are the result of ice jams during winter. These soils are 2 to 4 feet higher than the main terraces. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Saunders soil is gray silty clay loam about 14 inches thick. The upper 18 inches of the underlying material is gray silty clay loam, the next 13 inches is light gray silty clay, and the lower part to a depth of 60 inches or more is gray clay.

Permeability is slow. Available water capacity is about 8 inches. This soil is moderately sodium- and salt-affected in the upper 12 inches and moderately sodium-affected and slightly salt-affected below this depth. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table is at a depth of 12 to 24 inches from April through September. This soil is subject to rare, brief periods of flooding from January through June. It is calcareous throughout.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of salts in the surface layer and the seasonal high water table.

Rangeland management. The potential native plant community is mainly basin wildrye, alkali sacaton, alkali cordgrass, western wheatgrass, inland saltgrass, alkali bluegrass, and greasewood. If the rangeland is overgrazed, the proportion of basin wildrye, alkali sacaton, alkali cordgrass, and alkali bluegrass decreases and the proportion of western wheatgrass, inland saltgrass, and greasewood increases. If overgrazing continues, plants such as foxtail barley, belvedere summercypress, rubber rabbitbrush, and Canada thistle may invade. The potential native plant community produces about 3,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,100 pounds in years of below-normal precipitation.

Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. This unit is poorly suited to seeding because of the high content of sodium and salts, which reduces seedling survival.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by wetness and salinity.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding.

This map unit is in capability subclass VIw, nonirrigated. It is in Saline Lowland range site, 10- to 14-inch precipitation zone.

113—Saunders silty clay loam, reclaimed, 0 to 2 percent slopes. This deep, poorly drained soil is on terraces in the Madison Valley. It formed in alluvium. Elevation is 4,800 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of wet soils in old stream meander channels that are 5 to 20 feet wide and 1 to 2 feet lower than the terraces. Also included are small areas of soils on mounds that are the result of ice jams during winter. These soils are in areas 2 to 4 feet higher than the terraces. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Saunders soil is gray silty clay loam about 14 inches thick. The upper 18 inches of the underlying material is gray silty clay loam, the next 13 inches is light gray silty clay, and the lower part to a depth of 60 inches or more is gray clay.

Permeability is slow. Available water capacity is about 10 inches. This soil is slightly sodium-affected. Effective rooting depth is about 60 inches. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table is at a depth of 36 to 60 inches from April through September. This soil is subject to rare, brief periods of flooding from January through June. It is calcareous throughout.

This unit is used for irrigated crops, mainly clover and alfalfa for hay, grass for pasture, barley, and oats.

Cropland management. The main management concerns in using this unit for irrigated crops are drainage system maintenance, prevention of a high accumulation of salt in the upper part of the soil, soil blowing, and maintenance of good soil tilth. Drainage is needed to remove excess water and to prevent the accumulation of salts at a depth of less than about 30 inches. Good irrigation water management is necessary

to avoid application of too much water and to keep salts leached from the root zone. Sprinkler irrigation is suitable for the controlled application of water. The surface layer of the soil is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content, increases fertility, reduces the risk of soil blowing, and helps to improve soil tilth.

Windbreak management. This unit is suited to windbreaks, but the seasonal high water table limits the choice of trees and shrubs to those that are water tolerant. Suitable trees for planting are white willow, golden willow, cottonwood, Russian olive, Siberian elm, Rocky Mountain juniper, and blue spruce. Suitable shrubs are common chokecherry, purpleosier willow, and silver buffaloberry.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding.

This map unit is in capability subclass IVw, irrigated.

114—Scravo sandy loam, cool, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the Madison and Ruby Valleys. It formed in gravelly or cobbly alluvium. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Kalsted and Crago soils. Also included are small areas of soils that have a gravelly or cobbly surface layer. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Scravo soil, where mixed to a depth of 7 inches, is very pale brown sandy loam. The upper 9 inches of the underlying material is white gravelly sandy loam, and the lower part to a depth of 60 inches or more is extremely gravelly loamy sand. Depth to gravelly and sandy material is 5 to 18 inches. In some areas the surface layer is loam or gravelly loam.

Permeability is moderately rapid to a depth of about 16 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout. It is droughty because of the high content of coarse fragments and the sandy texture of the lower part of the soil.

This unit is used mainly as rangeland. It is also used for irrigated crops. The main irrigated crops are alfalfa, grass, and small grain. The unit is poorly suited to nonirrigated crops because of droughtiness and the low available water capacity.

Cropland management. If this unit is used for irrigated crops, it is limited by the hazards of soil blowing and water erosion. Sprinkler irrigation is the most suitable method of applying water. Because the soil is droughty, light and frequent applications of irrigation water are needed. The surface layer is high in content of lime and low in content of organic matter. Crops respond well to phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility and helps to control runoff and water erosion. If the soil in this unit is cultivated, fall plowing should be avoided to minimize soil blowing.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Indian ricegrass, needleandthread, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, blue grama, Sandberg bluegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to nonirrigated windbreaks because of droughtiness. If irrigated, suitable trees for planting are Russian olive, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, skunkbush sumac, and lilac.

Homesite development. This unit is suited to homesite development. Because the underlying material is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclasses VIs, nonirrigated, and IVs, irrigated. It is in Shallow to Gravel range site, 10- to 14-inch precipitation zone.

115—Scravo very cobbly sandy loam, cool, 0 to 4 percent slopes. This deep, well drained soil is on terraces in the Madison and Ruby Valleys. It formed in cobbly and gravelly alluvium. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Thess and Crago soils. The Thess soils are in small concave areas, and the Crago soils are scattered throughout the unit. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Scravo soil is grayish brown very cobbly sandy loam about 5 inches thick. The upper 4 inches of the underlying material is light gray very gravelly sandy loam, and the lower part to a depth of 60 inches or more is very gravelly sand. Depth to gravelly and sandy material is 5 to 10 inches.

Permeability is moderately rapid to a depth of about 9 inches and rapid below this depth. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is droughty because of the high content of coarse fragments and the sandy texture of the lower part of the soil.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of droughtiness and the very cobbly surface layer.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Indian ricegrass, needleandthread, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, blue grama, Sandberg bluegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on this unit if the rangeland vegetation is in poor condition. Reestablishing plant cover is difficult.

Windbreak management. This unit is very poorly suited to windbreaks because of droughtiness and the high content of coarse fragments.

Homesite development. This unit is suited to homesite development. Because the underlying material is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIs, nonirrigated. It is in Shallow to Gravel range site, 10- to 14-inch precipitation zone.

116—Scravo-Crago complex, cool, 2 to 8 percent slopes. This map unit is on fans and in drainageways in the Ruby Valley. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 70 percent Scravo very cobbly sandy loam and 25 percent Crago loam. The Scravo soil is in convex areas, and the Crago soil is in swales.

Included in this unit are small, randomly distributed areas of Musselshell soils, soils that have a stony surface layer, and recent alluvium. Included areas make up about 5 percent of the total acreage.

The Scravo soil is deep and well drained. It formed in gravelly and cobbly alluvium. Typically, the surface layer is grayish brown very cobbly sandy loam about 5 inches thick. The upper 12 inches of the underlying material is light gray very gravelly sandy loam, and the lower part to a depth of 60 inches or more is very gravelly sand. Depth to gravelly and sandy material is 5 to 18 inches.

Permeability is moderately rapid to a depth of about 17 inches and rapid below this depth. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is droughty because of the high content of coarse fragments and the sandy texture of the lower part of the soil.

The Crago soil is deep and well drained. It formed in gravelly alluvium derived dominantly from limestone. Typically, the surface layer is light brownish gray loam about 7 inches thick. The upper 7 inches of the underlying material is light gray gravelly loam, the next 18 inches is white very gravelly sandy loam, and the lower part to a depth of 60 inches or more is light brownish gray extremely gravelly loamy sand.

Permeability is moderate to a depth of about 32 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 60

inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout. It is droughty because of the high content of coarse fragments and the sandy texture of the lower part.

The soils in this unit are used as rangeland. They are very poorly suited to cultivated crops because of droughtiness and the very cobbly surface layer of the Scravo soil.

Rangeland management. The potential native plant community on the Scravo soil is mainly bluebunch wheatgrass, Indian ricegrass, needleandthread, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, blue grama, Sandberg bluegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The potential native plant community on the Crago soil is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on the soils in this unit if the rangeland vegetation is in poor condition. Reestablishing plant cover is difficult.

Windbreak management. The soils in this unit are very poorly suited to windbreaks because of droughtiness and the high content of coarse fragments.

Homesite development. The main limitation for homesite development on the soils in this unit is the rapid permeability of the underlying material. Because of this limitation, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIs, nonirrigated. The Scravo soil is in Shallow to Gravel range site, 10- to 14-inch precipitation zone, and the Crago soil is in Silty range site, limy, 10- to 14-inch precipitation zone.

117—Scravo-Thess complex, cool, 0 to 4 percent slopes. This map unit is on fans and terraces in the Madison and Ruby Valleys. Elevation is 4,500 to 5,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 65 percent Scravo cobbly sandy loam and 35 percent Thess loam. The Scravo soil is in convex areas, and the Thess soil is in swales.

The Scravo soil is deep and well drained. It formed in gravelly and cobbly alluvium. Typically, the surface layer is grayish brown cobbly sandy loam about 5 inches thick. The upper 12 inches of the underlying material is light gray very cobbly sandy loam, the next 25 inches is pale brown very gravelly loamy sand, and the lower part to a depth of 60 inches or more is very pale brown extremely gravelly sand. Depth to gravelly and sandy material is 5 to 18 inches.

Permeability is moderately rapid to a depth of about 17 inches and rapid below this depth. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 24 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is droughty because of the high content of coarse fragments and the sandy texture of the lower part.

The Thess soil is deep and well drained. It formed in alluvium. Typically, the surface layer is brown loam 7 inches thick. The upper 12 inches of the underlying material is very pale brown loam, the next 11 inches is very pale brown gravelly loam, and the lower part to a depth of 60 inches or more is gray very gravelly sand. Depth to sandy and gravelly material is 20 to 30 inches.

Permeability is moderate to a depth of about 30 inches and very rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

The soils in this unit are used mainly as rangeland. Some areas are used for irrigated pasture and hay. The soils are poorly suited to other cultivated crops because

of droughtiness and the content of coarse fragments in the surface layer of the Scravo soil. Sprinkler irrigation is the most suitable method of applying water. Because the Scravo soil is droughty, light and frequent applications of irrigation water are needed. Coarse fragments on the surface make seedbed preparation difficult.

Rangeland management. The potential native plant community on the Scravo soil is mainly bluebunch wheatgrass, Indian ricegrass, needleandthread, western wheatgrass, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, Sandberg bluegrass, blue grama, prairie junegrass, and skunkbush sumac increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The potential native plant community on the Thess soil is mainly bluebunch wheatgrass, western wheatgrass, needleandthread, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of western wheatgrass, needleandthread, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Seeding of native plants or adapted introduced grasses and legumes is a suitable practice on the soils in this unit if the rangeland vegetation is in poor condition. Reestablishing plant cover is difficult.

Windbreak management. The soils in this unit are not suited to nonirrigated windbreaks because of the low available water capacity. If irrigated, trees suitable for planting are Russian olive, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, skunkbush sumac, and lilac.

Homesite development. The main limitation for homesite development on the soils in this unit is the rapid and very rapid permeability of the underlying material. Because of this limitation, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclasses VIs, nonirrigated, and IVe, irrigated. The Scravo soil is in Shallow to Gravel range site, 10- to 14-inch precipitation zone, and the Thess soil is in Silty range site, limy, 10- to 14-inch precipitation zone.

118—Sebud-Hapgood complex, 8 to 45 percent slopes. This map unit is on moraines, mountainsides, and hills. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days. Where these soils occur in Centennial Valley, annual precipitation is about 22 inches.

This unit is about 50 percent Sebud very stony loam and 35 percent Hapgood gravelly loam. The Sebud soil is mainly on south-facing slopes and ridges, and the Hapgood soil is mainly on north-facing slopes and in depressional areas.

Included in this unit are small, randomly distributed areas of Oro Fino soils and Rock outcrop. Included areas make up about 15 percent of the total acreage.

The Sebud soil is deep and well drained. It formed in glacial till derived dominantly from gneiss and schist. Typically, the surface layer is very dark grayish brown very stony loam about 14 inches thick. The upper part of the subsoil is yellowish brown very stony sandy clay loam about 16 inches thick, and the lower part is light yellowish brown very stony coarse sandy loam about 16 inches thick. The substratum to a depth of 60 inches or more is pale brown very stony coarse sandy loam.

Permeability is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Hapgood soil is deep and well drained. It formed in glacial till derived dominantly from gneiss and schist. Typically, the surface layer is very dark grayish brown gravelly loam about 18 inches thick. The underlying material to a depth of 60 inches or more is grayish brown very gravelly loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are

not suited to cultivated crops because of the high content of rock fragments, the short growing season, and slope.

Rangeland management. The potential native plant community on the Sebud soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential native plant community on the Hapgood soil is mainly mountain brome, Richardson needlegrass, basin wildrye, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and other perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical. The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope and the stones on the surface of the Sebud soil.

Homesite development. The main limitations for homesite development on the soils in this unit are slope and the moderate permeability of the soils. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. If the soils are used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Effluent from absorption fields can surface in downslope areas and create a hazard to health. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIIs, nonirrigated. It is in Thin Silty range site, 15- to 19-inch precipitation zone.

119—Sebud-Hapgood-Rock outcrop complex, 25 to 60 percent slopes. This map unit is on mountainsides, hills, and ridges. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days. Annual precipitation is about 22 inches where this unit occurs in the Centennial Valley.

This unit is about 40 percent Sebud very flaggy loam, 40 percent Hapgood gravelly loam, and 15 percent Rock outcrop. The Sebud soil is mainly on south-facing slopes and ridges, the Hapgood soil is mainly on north-facing slopes and in depressional areas, and the Rock outcrop is on ridges, hills, and small escarpments. In some small areas the Rock outcrop includes nearly barren talus slopes.

Included in this unit are small, randomly distributed areas of Adel, Poin, and Tiban soils. Included areas make up about 5 percent of the total acreage.

The Sebud soil is deep and well drained. It formed in colluvium derived dominantly from gneiss and schist. Typically, the surface layer is brown very flaggy loam about 14 inches thick. The upper 16 inches of the subsoil is yellowish brown very stony sandy clay loam. The lower part of the subsoil and the substratum to a depth of 60 inches or more are light yellowish brown and very pale brown very stony coarse sandy loam.

Permeability is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Hapgood soil is deep and well drained. It formed in colluvium derived dominantly from gneiss and schist. Typically, the surface layer is very dark grayish brown gravelly loam about 18 inches thick. The underlying material to a depth of 60 inches or more is grayish brown very gravelly loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

The hazard of soil blowing is moderate.

The Rock outcrop consists of exposures of fractured gneiss and schist.

This unit is used as rangeland. It is not suited to cultivated crops because of slope, the short growing season, and the areas of Rock outcrop.

Rangeland management. The potential native plant community on the Sebud soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential native plant community on the Hapgood soil is mainly mountain brome, Richardson needlegrass, basin wildrye, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

The areas of Rock outcrop provide little useable forage for livestock; however, shrubs growing in the fractures provide some forage for wildlife.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope and the areas of Rock outcrop.

Homesite development. This unit is poorly suited to homesite development because of slope.

This map unit is in capability subclass VIIe, nonirrigated. It is in Thin Silty range site, 15- to 19-inch precipitation zone.

120—Sebud-Rochester-Rock outcrop complex, 25 to 60 percent slopes. This map unit is on mountainsides in the northeastern part of the survey area. Elevation is 6,800 to 7,800 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 39 degrees F, and the average frost-free period is about 90 days.

This unit is about 40 percent Sebud very gravelly sandy loam, 20 percent Rochester very stony loamy sand, and 20 percent Rock outcrop. The Sebud soil is on side slopes and ridges, the Rochester soil is on slopes along drainageways, and the Rock outcrop is on ridges.

Included in this unit are small, randomly distributed areas of Hapgood, Oro Fino, and Earcree soils. Also included are extremely bouldery soils on foot slopes and in drainageways. Included areas make up about 20 percent of the total acreage.

The Sebud soil is deep and well drained. It formed in colluvium derived from granite. Typically, the surface layer is brown very gravelly sandy loam about 8 inches thick. The subsoil is yellowish brown very channery sandy clay loam about 15 inches thick. The substratum to a depth of 60 inches or more is pale brown very stony sandy loam.

Permeability is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 40 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Rochester soil is deep and excessively drained. It formed in colluvium derived from granite. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is pale brown very stony loamy sand about 17 inches thick. The subsurface layer is very pale brown very gravelly loamy sand about 13 inches thick. The underlying material to a depth of 60 inches or more is pale brown very gravelly loamy sand.

Permeability is rapid. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The Rock outcrop consists of exposures of granite.

The Sebud soil in this unit is used as rangeland. The Rochester soil is used as woodland and for understory grazing. This unit is not suited to cultivated crops

because of slope, the high content of coarse fragments, and the areas of Rock outcrop.

Rangeland management. The potential native plant community on the Sebud soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential native forest understory on the Rochester soil is mainly pinegrass, elk sedge, bluebunch wheatgrass, Idaho fescue, Rocky Mountain juniper, and common snowberry. It produces about 300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 100 pounds in years of below-normal precipitation.

The Rock outcrop supports a few shrubs that grow in the fractures.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. The surface layer of the soils in this unit is susceptible to water erosion if it is disturbed or the rangeland is overgrazed. Overgrazing can encourage an increase in the forest canopy and reduce the cover of desirable forage plants.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope.

Forest management. The Rochester soil is suited to Douglas fir and lodgepole pine. The site index for Douglas fir is 38. The potential annual production (CMAI) per acre is about 50 cubic feet or 140 board feet (Scribner rule). Potential production is for an even-aged, fully stocked stand of trees. Yield estimates for lodgepole pine were not made.

The main limitation for timber management is slope. Water erosion is a hazard on the soils in this unit if they are disturbed. Steepness of slope and the high hazard of water erosion make timber harvesting operations and other forest management activities very difficult.

Homesite development. This unit is poorly suited to homesite development because of slope.

This map unit is in capability subclass VIIe, nonirrigated. The Sebud soil is in Thin Silty range site, 15- to 19-inch precipitation zone, and the Rochester soil is in woodland suitability group 3R.

121—Shadow very channery loam, 15 to 45 percent slopes. This deep, somewhat excessively drained soil is on glacial moraines and mountainsides in the eastern part of the survey area. It formed in alluvium, colluvium, and glacial till derived from mixed rock sources. Elevation is 7,000 to 8,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 36 degrees F, and the average frost-free period is about 45 days.

Included in this unit are small areas of Mikesell soils and soils that are shallow over shale. Also included are small areas of poorly drained soils along drainageways, very stony soils, soils that have very steep, short slopes, and soils in lower lying areas and on south-facing slopes that support stands of Douglas fir. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Shadow soil is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is pale brown very channery loam about 10 inches thick. The subsoil is pale brown extremely channery sandy loam about 20 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely channery sandy loam.

Permeability is moderately rapid. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is more than 60 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly grouse whortleberry, blue huckleberry, white spirea, and heartleaf arnica. It produces about 600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 300 pounds in years of below-normal precipitation.

Forest management. This unit is suited to lodgepole pine, Engelmann spruce, and subalpine fir. The site index is 66 for lodgepole pine and 71 for Engelmann spruce. The potential annual production (CMAI) per acre of lodgepole pine is about 65 cubic feet or 190 board feet (Scribner rule), and for Engelmann spruce it is 65 cubic feet or 275 board feet. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

The main limitations for timber management are

slope and the low available water capacity. Steepness of slope limits the kinds of equipment that can be used. Understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard on this unit if it is disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. The main limitation for roads on this unit is slope. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIe, nonirrigated. It is in woodland suitability group 4R.

122—Shadow very flaggy loam, 45 to 70 percent slopes. This deep, somewhat excessively drained soil is on glacial moraines and mountainsides in the eastern part of the survey area. It formed in alluvium, colluvium, and glacial till derived from mixed rock sources. Elevation is 7,000 to 8,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 36 degrees F, and the average frost-free period is about 45 days.

Included in this unit are small, randomly distributed areas of Mikesell soils, soils that are shallow over shale, and Shadow soils that support stands of Douglas fir. Also included are small areas of Rock outcrop, mainly on ridgetops, poorly drained soils along drainageways, and very stony soils. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Shadow soil is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is very pale brown very flaggy loam about 6 inches thick. The subsoil is pale brown extremely channery sandy loam about 11 inches thick. The substratum to a depth of 60 inches or more is very pale brown extremely channery sandy loam.

Permeability is moderately rapid. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is more than 60 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly grouse whortleberry, blue huckleberry, white spirea, and heartleaf arnica. The understory provides a limited amount of forage. The potential native forest understory produces about 600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 300 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

Forest management. This unit is suited to lodgepole pine, Engelmann spruce, and subalpine fir. The site index is 66 for lodgepole pine and 71 for Engelmann spruce. The potential annual production (CMAI) per acre of lodgepole pine is about 65 cubic feet or 190 board feet (Scribner rule), and for Engelmann spruce it is 65 cubic feet or 275 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

The main limitations for timber management are slope and the low available water capacity. Steepness of slope limits the kinds of equipment that can be used. Track-type tractors can be used effectively on most slopes; however, line skidding should be considered for use in the steeper areas. Understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard on this unit if it is disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. The main limitation of this unit for roads is slope. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated. It is in woodland suitability group 4R.

123—Shadow complex, warm, 15 to 45 percent slopes. These deep, somewhat excessively drained soils are on fans, mountainsides, and glacial moraines. They formed in glacial till, colluvium, and alluvium derived from mixed sources. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 24

inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This map unit is about 65 percent Shadow very channery sandy loam and 20 percent Shadow stony loam.

Included in this unit are small areas of Sebud, MacFarlane, and Comad soils, soils that support stands of subalpine fir, and Rock outcrop. Also included are small areas of Shadow soils that have a sandy loam surface layer and areas of moderately sloping soils on terraces. The Sebud soils are on south-facing slopes and are mainly in areas of grassland. The MacFarlane soils are on small terraces and are less sloping than the Shadow soils. The soils that support subalpine fir are on north-facing slopes in the higher-lying areas. The Comad soils are on south-facing slopes, small fans, and alluvial bottoms. The Rock outcrop is scattered throughout the unit, mostly along ridges. Some areas of the moderately sloping soils on terraces are as much as 50 acres in size. Included areas make up about 15 percent of the total acreage.

Typically, the surface of the Shadow very channery sandy loam is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is brown very channery sandy loam about 3 inches thick. The subsurface layer is pale brown very channery sandy loam about 14 inches thick. The subsoil is brown extremely channery sandy loam, and the substratum is pale brown extremely channery sandy loam.

Permeability is moderately rapid. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is more than 60 inches. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is high.

Typically, the surface of the Shadow stony loam is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light gray stony loam about 10 inches thick. The subsoil and substratum to a depth of 60 inches or more are mainly light gray extremely channery sandy loam.

Permeability is moderately rapid. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The soils in this unit are used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly raceme pussytoes, pinegrass, heartleaf arnica, Engelmann aster, and common snowberry. It produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation. Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas.

Forest management. The soils in this unit are suited to Douglas fir, lodgepole pine, and Engelmann spruce. The site index is 46 for Douglas fir, 62 for lodgepole pine, and 82 for Engelmann spruce. The potential annual production (CMAI) per acre is about 60 cubic feet or 200 board feet (Scribner rule) for Douglas fir, 60 cubic feet or 170 board feet for lodgepole pine, and 80 cubic feet or 340 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees.

The main limitations for timber management are slope and the low available water capacity. Steepness of slope and stones on the surface limit the kinds of equipment that can be used. The understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard on the soils in this unit if they are disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. If the soils in this unit are used for roads, they are limited mainly by slope and stones in the surface layer. Stoniness makes excavation, leveling, and road construction difficult. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIe, nonirrigated. It is in woodland suitability group 4R.

124—Shadow complex, warm, 45 to 70 percent slopes. These deep, somewhat excessively drained soils are on mountainsides and glacial moraines. They formed in colluvium and glacial till derived from mixed sources. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 24 inches, the average

annual air temperature is about 38 degrees F, and the average frost-free season is about 75 days.

This unit is about 50 percent Shadow very channery sandy loam and 25 percent Shadow stony loam.

Included in this unit are small areas of Sebud and Comad soils, areas of soils that support subalpine fir, and Rock outcrop. Also included are small areas of Shadow soils that have a sandy loam surface layer. The Sebud soils are on south-facing slopes and commonly are in areas of grassland. The Comad soils are on south-facing slopes, fans, and alluvial bottoms. The soils that support subalpine fir are on north-facing slopes in higher lying areas. The Rock outcrop is throughout the unit, mostly along ridges. Included areas make up about 25 percent of the total acreage.

Typically, the surface of the Shadow very channery sandy loam is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is light gray very channery sandy loam about 9 inches thick. The subsoil and substratum to a depth of 60 inches or more are yellowish brown extremely channery sandy loam.

Permeability is moderately rapid. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

Typically, the surface of the Shadow stony loam is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light gray stony loam about 10 inches thick. The subsoil and substratum to a depth of 60 inches or more are mainly light gray extremely channery sandy loam.

Permeability is moderately rapid. Available water capacity is about 3 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly raceme pussytoes, pinegrass, heartleaf arnica, Engelmann aster, and common snowberry. It produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

Forest management. The soils in this unit are suited to Douglas fir, lodgepole pine, and Engelmann spruce. The site index is 46 for Douglas fir, 62 for lodgepole pine, and 82 for Engelmann spruce. The potential annual production (CMAI) per acre is about 60 cubic feet or 200 board feet (Scribner rule) for Douglas fir, 60 cubic feet or 170 board feet for lodgepole pine, and 80 cubic feet or 340 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees.

The main limitations for timber management are slope and the low available water capacity. Steepness of slope limits the kinds of equipment that can be used. Track-type tractors can be used effectively on most slopes; however, line skidding should be considered for use in the steeper areas. Water erosion is a hazard on the soils in this unit if they are disturbed. The understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. If the soils in this unit are used for roads, they are limited mainly by slope and stones in the surface layer. Stoniness makes excavation, leveling, and road construction difficult. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated. It is in woodland suitability group 4R.

125—Shadow, warm-Mikesell-Worock complex, 45 to 70 percent slopes. This map unit is on mountainsides in the eastern part of the survey area. Elevation is 6,500 to 7,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 35 percent Shadow channery loam, warm; 35 percent Mikesell clay loam; and 15 percent Worock gravelly loam. The Shadow soil is on the upper part of mountainsides, the Mikesell soil is on the less sloping, lower lying mountainsides, and the Worock soil is on the midslopes of mountainsides, between areas of the Shadow and Mikesell soils.

Included in this unit are small areas of Shedhorn

soils, areas of shale and sandstone outcrop, and poorly drained soils in stream valleys and swales. Also included are small areas of soils that support subalpine fir. These soils are in the higher-lying areas. Included areas make up about 15 percent of the total acreage.

The Shadow soil is deep and somewhat excessively drained. It formed in colluvium derived from mixed rock sources. Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is light brownish gray channery loam about 17 inches thick. The subsoil is light gray very channery sandy loam 13 inches thick. The substratum to a depth of 60 inches or more is extremely channery sandy loam.

Permeability is moderately rapid. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Mikesell soil is deep and well drained. It formed in material derived from shale. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light brownish gray clay loam about 8 inches thick. The upper 6 inches of the subsoil is very pale brown clay, and the lower part to a depth of 60 inches or more is brown shaly clay.

Permeability is slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Worock soil is deep and well drained. It formed in colluvium derived from mixed rock sources. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is pale brown gravelly loam about 12 inches thick. The subsurface layer is very pale brown gravelly loam about 12 inches thick. The subsoil to a depth of 60 inches or more is brown very cobbly sandy clay loam.

Permeability is moderately slow. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as woodland and for understory grazing.

Rangeland management. The potential native forest understory on the Shadow soil is mainly raceme pussytoes, pinegrass, heartleaf arnica, Engelmann aster, and common snowberry. It produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation.

The potential native forest understory on the Mikesell soil is mainly heartleaf arnica, western meadowrue, pinegrass, and grouse whortleberry. It produces about 800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

The potential native forest understory on the Worock soil is mainly grouse whortleberry, blue huckleberry, silvery lupine, and white spirea. It produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock grazing in areas where access is limited.

Forest management. The Shadow soil is suited to Douglas fir, lodgepole pine, and Engelmann spruce. The site index is 46 for Douglas fir, 62 for lodgepole pine, and 82 for Engelmann spruce. The potential annual production (CMAI) per acre is about 60 cubic feet or 200 board feet (Scribner rule) for Douglas fir, 60 cubic feet or 170 board feet for lodgepole pine, and 80 cubic feet or 340 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees.

The Mikesell soil is suited to Douglas fir, lodgepole pine, Engelmann spruce, and subalpine fir. The site index is 52 for Douglas fir, 67 for lodgepole pine, and 84 for Engelmann spruce. The potential annual production (CMAI) per acre is about 75 cubic feet or 250 board feet (Scribner rule) for Douglas fir, 65 cubic feet or 190 board feet for lodgepole pine, and 80 cubic feet or 360 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

The Worock soil is suited to lodgepole pine, Douglas fir, Engelmann spruce, and subalpine fir. The site index is 64 for lodgepole pine, 57 for Douglas fir, and 77 for Engelmann spruce. The potential annual production (CMAI) per acre is about 60 cubic feet or 180 board feet (Scribner rule) for lodgepole pine, 75 cubic feet or 250 board feet for Douglas fir, and 70 cubic feet or 320

board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

Timber management on this unit is limited by slope, the low available water capacity of the Shadow soil, and the high content of clay in the Mikesell soil. Steepness of slope limits the kinds of equipment that can be used. Track-type tractors can be used effectively on most slopes; however, line skidding should be considered for use in the steeper areas. The Mikesell soil has low strength when wet; this results in poor trafficability and the possibility of soil compaction when heavy equipment is used to yard logs. Operating equipment only when the soil is dry or frozen can overcome this limitation. Water erosion is a hazard on the soils in this unit if they are disturbed. Understory vegetation competes vigorously with tree seedlings. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. If the soils in this unit are used for roads, they are limited mainly by slope. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and the production of sediment from roads on the Shadow and Worock soils. Low soil strength and shrink-swell potential are limitations on the Mikesell soil. The low strength of the soil when wet, shrinking and swelling, and steepness of slope adversely affect road performance and soil stability. The Mikesell soil should be avoided when building roads on this unit.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated. The Shadow soil is in woodland suitability group 4R, the Mikesell soil is in woodland suitability group 6R, and the Worock soil is in woodland suitability group 5R.

126—Shedhorn clay loam, 8 to 25 percent slopes. This deep, moderately well drained soil is on mountainsides in the Madison Range, in the eastern part of the survey area. It formed in colluvium and glacial till derived from shale and sandstone. Many areas have been subject to landsliding, and some of these show recent movement. Slope is 8 to 25 percent. Slopes are strongly rolling and hilly and commonly are less than 250 feet long. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 36 degrees F, and the average frost-free period is about 45 days.

Included in this unit are small areas of Mikesell soils, poorly drained soils, and shallow soils that have short, steep slopes. The poorly drained soils are in swales and closed basins. The Mikesell soils are throughout the unit and support forest vegetation. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Shedhorn soil is grayish brown loam about 4 inches thick. The subsurface layer is grayish brown clay loam about 8 inches thick. The subsoil is light brownish gray clay 28 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown shaly clay loam.

Permeability is slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is very poorly suited to cultivated crops because of the short growing season and slope.

Rangeland management. The potential native plant community is mainly spike fescue, basin wildrye, Columbia needlegrass, bearded wheatgrass, mountain brome, Idaho fescue, purple oniongrass, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Columbia needlegrass, bearded wheatgrass, mountain brome, and purple oniongrass decreases and the proportion of Idaho fescue, mountain big sagebrush, and lupine increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and annual forbs may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. This unit is poorly suited to homesite development. Some areas of the unit are unstable and are moving downslope; therefore, onsite investigation of potential building sites is needed before starting construction.

This map unit is in capability subclass VIe,

nonirrigated. It is in Clayey range site, 20- to 24-inch precipitation zone.

127—Shedhorn, cool-Garlet, cool-Rock outcrop complex, 30 to 70 percent slopes. This map unit is on mountainsides in the Madison Range, in the eastern part of the survey area. Slope is 30 to 70 percent. Elevation is 8,000 to 9,500 feet. The average annual precipitation is about 40 inches, the average annual air temperature is about 34 degrees F, and the average frost-free period is about 30 days.

This unit is about 40 percent Shedhorn clay loam, 30 percent Garlet very flaggy loam, and 20 percent Rock outcrop. The Shedhorn soil is on foot slopes, in drainageways, and scattered throughout the unit; the Garlet soil is on mountainsides; and the Rock outcrop is mainly on ridges but is scattered throughout the unit.

Included in this unit are small, randomly distributed areas of Mikesell and Whitore soils. Included areas make up about 10 percent of the total acreage.

The Shedhorn soil is deep and moderately well drained. It formed in colluvium derived from shale and sandstone. Typically, the surface layer is grayish brown clay loam about 12 inches thick. The subsoil is light brownish gray clay about 28 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown shaly clay loam.

Permeability is slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Garlet soil is deep and well drained. It formed in colluvium derived from sandstone, quartzite, and andesite. Typically, the surface is covered with a mat of partially decomposed forest litter about 1 inch thick. The surface layer is pale brown very flaggy loam about 15 inches thick. The subsoil is light yellowish brown very flaggy loam about 11 inches thick. The substratum to a depth of 60 inches or more is pale brown very flaggy loam.

Permeability is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Rock outcrop consists mainly of exposures of shale and sandstone.

The soils in this unit are used as rangeland and woodland and for understory grazing. They are not suited to cultivated crops because of slope, the short growing season, and the areas of Rock outcrop.

Rangeland management. The potential native plant community on the Shedhorn soil is mainly rough fescue, purple reedgrass, Richardson needlegrass, Columbia needlegrass, mountain brome, basin wildrye, and Idaho fescue. If the rangeland is overgrazed, the proportion of rough fescue, Richardson needlegrass, Columbia needlegrass, mountain brome, and basin wildrye decreases and the proportion of sedges, cinquefoil, Idaho fescue, eriogonum, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and weedy forbs and annuals may invade. The potential native plant community produces about 2,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

The potential native forest understory on the Garlet soil is mainly grouse whortleberry, silvery lupine, and heartleaf arnica. The understory produces about 200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 100 pounds in years of below-normal precipitation.

The Rock outcrop supports little if any vegetation.

Snowfall early and late in summer commonly limits grazing by livestock. Steepness of slope and the areas of Rock outcrop also limit access.

Windbreak management. This unit is very poorly suited to windbreaks. The main limitation is steepness of slope.

Forest management. The Garlet soil is suited to subalpine fir, whitebark pine, Engelmann spruce, and lodgepole pine. The site index for Engelmann spruce is 50. The potential annual production (CMAI) per acre is about 38 cubic feet or 160 board feet (Scribner rule) for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees. The site index for whitebark pine is 34. Yield estimates for subalpine fir, whitebark pine, and lodgepole pine were not made.

The main limitation for timber management is slope. Steepness of slope limits the kinds of equipment that can be used and the ease of operation. Track-type tractors can be used effectively on most slopes; however, line skidding should be considered for use in the steeper areas. Water erosion is a hazard if the soils are disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation. Understory vegetation competes with tree seedlings. Reduction of competing vegetation

encourages adequate natural regeneration and the survival of planted seedlings. Windthrow can be a hazard during periods of soil wetness and high winds.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope and the areas of Rock outcrop.

This map unit is in capability subclass VIIe, nonirrigated. The Shedhorn soil is in Clayey range site, cold, 20- to 24-inch precipitation zone. The Garlet soil is in woodland suitability group 3R.

128—Shedhorn-Rock outcrop complex, 15 to 45 percent slopes. This map unit is on mountainsides and glacial moraines in the Madison Range, in the eastern part of the survey area. Slope is 15 to 45 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 36 degrees F, and the average frost-free period is about 45 days.

This unit is about 70 percent Shedhorn clay loam and 15 percent Rock outcrop. The Rock outcrop is along ridges and in drainageways, and the Shedhorn soil is on mountainsides.

Included in this unit are small, randomly distributed areas of timbered soils that are similar to Mikesell and Whitore soils. Also included are small areas of poorly drained soils in swales and small basins, soils that are shallow to shale or sandstone, and talus. Included areas make up about 15 percent of the total acreage.

The Shedhorn soil is deep and moderately well drained. It formed in colluvium and glacial till derived from shale and sandstone. Typically, the surface layer is grayish brown loam about 4 inches thick. The subsurface layer is grayish brown clay loam about 8 inches thick. The subsoil is light brownish gray clay about 28 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown shaly clay loam.

Permeability is slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Rock outcrop consists of exposures of shale and sandstone.

This unit is used as rangeland. It is not suited to cultivated crops because of the short growing season, slope, and the areas of Rock outcrop.

Rangeland management. The potential native plant community on the Shedhorn soil is mainly spike fescue, basin wildrye, Columbia needlegrass, bearded wheatgrass, mountain brome, Idaho fescue, purple oniongrass, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of spike fescue, basin wildrye, Columbia needlegrass, bearded wheatgrass, mountain brome, and purple oniongrass decreases and the proportion of Idaho fescue, mountain big sagebrush, and lupine increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, onespike danthonia, and annual forbs may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope and the areas of Rock outcrop.

This map unit is in capability subclass VIIe, nonirrigated. The Shedhorn soil is in Clayey range site, 20- to 24-inch precipitation zone.

129—Shurley-Rentsac-Rock outcrop complex, 8 to 35 percent slopes. This map unit is on foot slopes, mountainsides, and foothills, mainly in the Ruby Valley. Slope is 8 to 35 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 35 percent Shurley very flaggy coarse sandy loam, 35 percent Rentsac channery sandy loam, and 20 percent Rock outcrop. The Shurley soil is on foot slopes, the Rentsac soil is adjacent to the Rock outcrop; and the Rock outcrop is mainly on slope breaks and ridgetops.

Included in this unit are small areas of Nuley and Yetull soils in less sloping areas. Included areas make up about 10 percent of the total acreage.

The Shurley soil is deep and well drained. It formed in colluvium derived from gneiss, schist, and granite. Typically, the surface layer is grayish brown very flaggy coarse sandy loam about 4 inches thick. The subsoil is pale brown very flaggy coarse sandy loam about 6 inches thick. The substratum to a depth of 60 inches or more is light gray and very pale brown very flaggy loamy coarse sand and very flaggy loamy sand.

Permeability is moderately rapid to a depth of about 10 inches and rapid below this depth. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native

vegetation, the average annual wetting depth is about 30 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

The Rentsac soil is shallow and well drained. It formed in material derived from gneiss and schist. Typically, the surface layer is grayish brown channery sandy loam about 4 inches thick. The underlying material to a depth of about 12 inches is light brownish gray very channery sandy loam. Gneiss and schist are at a depth of 12 inches. Depth to bedrock is 10 to 20 inches.

Permeability is moderately rapid. Available water capacity is about 1 inch. Effective rooting depth is 10 to 20 inches. Where this soil is under native vegetation, the average annual wetting depth is about 12 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Rock outcrop is exposures of hard gneiss, schist, and granite.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of shallow depth to bedrock in the Rentsac soil, the high content of coarse fragments, droughtiness, and slope.

Rangeland management. The potential native plant community on the Shurley soil is mainly bluebunch wheatgrass, western wheatgrass, Indian ricegrass, needleandthread, threadleaf sedge, green sagewort, and skunkbush sumac. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, green sagewort, and skunkbush sumac increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The potential native plant community on the Rentsac soil is mainly bluebunch wheatgrass, needleandthread, and antelope bitterbrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, Sandberg bluegrass, blue grama, threadleaf sedge, and antelope bitterbrush increases. If overgrazing continues, plants such as annual bromes, rubber rabbitbrush, and broom snakeweed may invade. The potential native plant community produces about 1,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 600 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical. Steepness of slope and the areas of Rock outcrop limit access by livestock. The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks because of the areas of Rock outcrop, the shallow depth to bedrock in the Rentsac soil, the high content of coarse fragments, droughtiness, and steepness of slope.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope, the shallow depth to bedrock in the Rentsac soil, and the areas of Rock outcrop.

This map unit is in capability subclass VIIe, nonirrigated. The Shurley soil is in Shallow to Gravel range site, 10- to 14-inch precipitation zone, and the Rentsac soil is in Shallow range site, 10- to 14-inch precipitation zone.

130—Shurley-Rock outcrop complex, 25 to 60 percent slopes. This map unit is on foot slopes, mountainsides, and hills throughout the survey area. Slope is 25 to 60 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 40 percent Shurley very flaggy coarse sandy loam and 40 percent Rock outcrop. The Shurley soil is on rough, broken slopes, and most of the areas of Rock outcrop occur as ledges. The areas of Rock outcrop are mainly small and scattered, but some areas are as much as 10 acres.

Included in this unit are small areas of Rentsac and Yetull soils and moderately sloping Nuley soils. The Rentsac soil is adjacent to the areas of Rock outcrop, and the Yetull soil is on small fans and foot slopes. Included areas make up about 20 percent of the total acreage.

The Shurley soil is deep and well drained. It formed in colluvium derived from gneiss, schist, and granite. Typically, the surface layer is grayish brown very flaggy coarse sandy loam about 4 inches thick. The subsoil is pale brown very flaggy coarse sandy loam about 6 inches thick. The substratum to a depth of 60 inches or more is light gray and very pale brown very flaggy loamy coarse sand and very flaggy loamy sand.

Permeability is moderately rapid to a depth of about 10 inches and rapid below this depth. Available water capacity is about 2 inches. Effective rooting depth is 60 inches or more. Where this soil is under native

vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The Rock outcrop is exposures of hard gneiss, schist, and granite.

This unit is used as rangeland. It is not suited to cultivated crops because of the steepness of slope, droughtiness, the areas of Rock outcrop, and the high content of flagstones in the surface layer of the Shurley soil.

Rangeland management. The potential native plant community on the Shurley soil is mainly bluebunch wheatgrass, western wheatgrass, needleandthread, threadleaf sedge, green sagewort, and skunkbush sumac. Small amounts of other plants, including Indian ricegrass, are also present. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and Indian ricegrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, green sagewort, and skunkbush sumac increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical. Slope and the areas of Rock outcrop limit access by livestock. The surface layer of the Shurley soil is susceptible to water erosion if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks because of the steepness of slope, the high content of coarse fragments, droughtiness, and the areas of Rock outcrop.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope and the areas of Rock outcrop.

This map unit is in capability subclass VIIe, nonirrigated. The Shurley soil is in Shallow to Gravel range site, 10- to 14-inch precipitation zone.

131—Thess sandy loam, cool, 2 to 4 percent slopes. This deep, well drained soil is on terraces and fans in the intermontane valleys of the survey area. It formed in mixed alluvium. Slope is 2 to 4 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Kalsted and Scravo soils. The Kalsted soils are in swales and on foot slopes, and the Scravo soils are on narrow terrace escarpments and in intermittent drainageways. Also included are small areas of soils that have a cobbly surface layer. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Thess soil is dark grayish brown sandy loam 7 inches thick. The upper 12 inches of the substratum is very pale brown loam, the next 11 inches is very pale brown gravelly loam, and the lower part to a depth of 60 inches or more is gray very gravelly sand. Depth to gravelly and sandy material is 20 to 30 inches.

Permeability is moderate to a depth of about 30 inches and very rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used for irrigated and nonirrigated crops and as rangeland. The main irrigated crops are alfalfa for hay, grass for hay and pasture, and small grain. The main nonirrigated crops are small grain and grass for pasture.

Cropland management. If this unit is used for cultivated crops, it is limited by the hazards of soil blowing and water erosion. Sprinkler irrigation is the most suitable method of applying water. Flood irrigation is not suitable because of the high water loss through deep percolation. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to the application of phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Minimum tillage, contour cultivation, using grassed waterways, stubble mulch tillage, and growing sod crops such as hay and pasture reduce runoff and water erosion. Minimum tillage, stubble mulch tillage, growing sod crops, and using tall grass barriers reduce soil blowing. Tall grass barriers also trap snow, which increases the amount of moisture in the soil. Fall plowing should be avoided to reduce soil blowing.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, needleandthread, prairie sandreed, Indian ricegrass, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, prairie sandreed, and Indian ricegrass decreases and the proportion of

needleandthread, thickspike wheatgrass, threadleaf sedge, prairie junegrass, blue grama, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. Because permeability is very rapid below a depth of 30 inches, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Sandy range site, 10- to 14-inch precipitation zone.

132—Thess loam, cool, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in the intermontane valleys of the survey area. It formed in mixed alluvium. Slope is 2 to 8 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Kalsted soils, Scravo soils, and soils that have a cobbly surface layer. The Kalsted soils are in swales and on foot slopes, and the Scravo soils are on narrow terrace breaks and in intermittent drainageways. Small seeps have developed in swales and low-lying areas because of uncontrolled application of irrigation water. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Thess soil is brown loam 7 inches thick. The upper 12 inches of the underlying material is very pale brown loam, the next 11 inches is very pale brown gravelly loam, and the lower part to a depth of 60 inches or more is gray very gravelly sand. Depth to gravelly and sandy material is 20 to 30 inches.

Permeability is moderate to a depth of about 30 inches and very rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

This unit is used as irrigated and nonirrigated cropland and as rangeland. The main irrigated crops are alfalfa for hay, grass for hay and pasture, and small grain. The main nonirrigated crops are small grain and grass for pasture.

Cropland management. If this unit is used for cultivated crops, it is limited by the hazards of soil blowing and water erosion. Sprinkler irrigation is suited to the unit. Flood irrigation is also suitable if contour ditches are used. The surface layer of the soil in this unit is high in content of lime and low in content of organic matter. Crops respond well to the application of phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Minimum tillage, contour cultivation, using grassed waterways, stubble mulch tillage, and growing sod crops such as hay and pasture reduce runoff and water erosion. Minimum tillage, stubble mulch tillage, growing sod crops, and using tall grass barriers reduce soil blowing. Tall grass barriers also trap snow, which increases the amount of moisture in the soil. Fall plowing should be avoided to reduce soil blowing.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The high content of lime in the soil, however, limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and

Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. Because permeability is very rapid below a depth of 30 inches, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, limy, 10- to 14-inch precipitation zone.

133—Thess-Amesha loams, cool, 0 to 2 percent slopes. This map unit is on terraces in the intermontane valleys of the survey area. Slope is 0 to 2 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 50 percent Thess loam and 45 percent Amesha loam. The Thess soil is in old intermittent drainageways. The Amesha soil cannot readily be identified by a unique landscape feature.

Included in this unit is about 5 percent Scravo soils. The Scravo soils are in old channels of drainageways.

The Thess soil is deep and well drained. It formed in alluvium. Typically, the surface layer is brown loam 7 inches thick. The upper 12 inches of the underlying material is very pale brown loam, the next 11 inches is very pale brown gravelly loam, and the lower part to a depth of 60 inches or more is gray very gravelly sand. Depth to gravelly and sandy material is 20 to 30 inches.

Permeability is moderate to a depth of about 30 inches and very rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is calcareous throughout.

The Amesha soil is deep and well drained. It formed in calcareous alluvium. Typically, the surface layer is light brownish gray loam 7 inches thick. The upper 43 inches of the underlying material is light brownish gray loam and thin strata of very fine sandy loam, and the lower part to a depth of 60 inches or more is light gray gravelly sandy loam and thin strata of loamy sand.

Permeability is moderate. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 18 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is calcareous throughout.

The soils in this unit are used mainly for irrigated crops, such as alfalfa, and grass and legumes for hay and pasture, and as rangeland. Small grain is grown in some areas. The soils are also used for nonirrigated crops, mainly small grain and grass for pasture.

Cropland management. If the soils in this unit are used for irrigated crops, they are limited by the hazard of soil blowing, restricted available water capacity, and the very rapid permeability of the lower part of the Thess soil. Sprinkler irrigation is the most suitable method of applying water. Flood irrigation is not suitable because of the high water loss because of deep percolation in the Thess soil. The surface layer of the soils in this unit is high in content of lime and low in content of organic matter. Crops respond well to the application of phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Soil blowing can be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. Fall plowing should be avoided to reduce soil blowing. Minimum tillage, stubble mulch tillage, and growing grasses and legumes for hay and pasture also reduce soil blowing.

If the soils in this unit are used for nonirrigated crops, they are limited by the hazard of soil blowing and by droughtiness. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Suitable methods for reducing soil blowing are stripcropping, using tall grass barriers and field windbreaks, minimum tillage, and stubble mulch tillage. Tall grass barriers trap snow, which increases the amount of moisture in the soil.

Rangeland management. The potential native plant community on the Thess soil is mainly bluebunch wheatgrass, needleandthread, western wheatgrass, horsebrush, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass decreases and the proportion of needleandthread, western wheatgrass, prairie junegrass, threadleaf sedge, horsebrush, and big sagebrush increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 1,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 800 pounds in years of below-normal precipitation.

The potential native plant community on the Amesha soil is mainly bluebunch wheatgrass, green

needlegrass, needleandthread, big sagebrush, and winterfat. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The surface layer of the soils in this unit is susceptible to soil blowing if it is disturbed or the rangeland is overgrazed. Proper grazing use ensures good plant vigor and adequate plant cover. Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, the unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. The soils in this unit are suited to homesite development. The main limitation of the Thess soil is the very rapid permeability of the underlying material. Because of this limitation, effluent from septic tank absorption fields may contaminate ground water. The main limitation of the Amesha soil is the moderate permeability. If this soil is used for septic tank absorption fields, this limitation can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass IVe, nonirrigated and irrigated. The Thess soil is in Silty range site, limy, 10- to 14-inch precipitation zone, and the Amesha soil is in Silty range site, 10- to 14-inch precipitation zone.

134—Tiban cobbly loam, 2 to 15 percent slopes. This deep, well drained soil is on foot slopes, hillsides, and terraces in the mountainous parts of the survey area and in the Missouri Flats area of the Upper Madison Valley. This soil formed in alluvium. Slope is 2 to 15 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Leavitt and Sebud soils. The Leavitt soils generally are in areas that receive more moisture such as foot slopes and depressional areas, and the Sebud soils are scattered throughout the unit. Also included are small areas of igneous rock outcrop. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Tiban soil is brown cobbly loam about 8 inches thick. The subsoil is grayish brown cobbly loam about 6 inches thick. The substratum to a depth of 60 inches or more is very pale brown and pale brown very cobbly loam. In some areas on the Missouri Flats, the surface layer is gravelly loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland.

Cropland management. This unit is suited to irrigated and nonirrigated pasture and hay. It is limited mainly by the short growing season. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Rock fragments in the surface layer may cause rapid wear of tillage equipment. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. This unit is poorly suited to small grain because of the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. This unit is suited to mechanical practices such as scalping, pitting, furrowing, and chiseling to improve areas of deteriorated rangeland.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which limits the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. The main limitations for homesite development on this unit are slope, the high content of coarse fragments, and the moderate permeability. If the unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Cobbles may make excavation and road construction difficult.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

135—Tiban very stony loam, 15 to 45 percent slopes. This deep, well drained soil is on moraines, hillsides, foot slopes, and terraces in the mountainous parts of the survey area. It formed in glacial till, colluvium, and alluvium. Slope is 15 to 45 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 16 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Sebud and Hapgood soils and Rock outcrop. The Sebud and Hapgood soils are scattered throughout the unit, and the Rock outcrop is on ridge crests. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Tiban soil is dark grayish brown very stony loam about 4 inches thick. The subsoil is brown very stony loam about 10 inches thick. The substratum to a depth of 60 inches or more is light gray very stony loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

This unit is used as rangeland. It is not suited to cultivated crops because of slope, stoniness, and the short growing season.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

Use of mechanical treatment is not practical because of the steepness of slope and stones on the surface. The surface layer is susceptible to water erosion if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks because of the steepness of slope.

Homesite development. The main limitations for homesite development on this unit are the steepness of slope, moderate permeability, and stoniness. If the unit used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Effluent from absorption fields can surface in downslope areas and create a hazard to health. Stoniness makes excavation, leveling, and road construction difficult.

This map unit is in capability subclass VIIs, nonirrigated. It is in Silty range site, 15- to 19-inch precipitation zone.

136—Tiban, moist-Rock outcrop complex, 8 to 45 percent slopes. This map unit is on mountainsides in the Ruby Range. Slope is 8 to 45 percent. Elevation is 7,500 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 60 percent Tiban very stony loam and 15 percent Rock outcrop.

Included in this unit are small, randomly distributed areas of Hanson and Whitore soils and dark-colored clayey soils. The Whitore soils support a dense stand of trees. Included areas make up about 25 percent of the total acreage.

The Tiban soil is deep and well drained. It formed in colluvium. Typically, the surface layer is brown very stony loam about 7 inches thick. The subsoil is light yellowish brown very gravelly loam about 15 inches thick. The substratum to a depth of 60 inches or more is

pale brown very gravelly loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 26 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is slight.

The soils in this unit are used as rangeland. They are not suited to cultivated crops because of the very stony surface layer, steepness of slope, the short growing season, and the areas of Rock outcrop.

Rangeland management. The potential native understory is mainly basin wildrye, bluebunch wheatgrass, Idaho fescue, Richardson needlegrass, mountain brome, rough fescue, and mountain big sagebrush. If the range is excessively grazed, the proportion of basin wildrye, bluebunch wheatgrass, mountain brome, rough fescue, and Richardson needlegrass decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as annual forbs, timothy, and Kentucky bluegrass may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation. This unit supports a few widely spaced Douglas fir. It is not an important source of timber, but selected trees can be harvested if economically feasible.

Use of mechanical treatment is not practical because of the very stony surface layer and steepness of slope.

Windbreak management. The soils in this unit are very poorly suited to windbreaks because of the high content of rock fragments in the surface layer, the areas of Rock outcrop, and steepness of slope.

Homesite development. The main limitations for homesite development on the soils in this unit are slope, moderate permeability, and stoniness. If the unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Effluent from absorption fields can surface in downslope areas and create a hazard to health. Stoniness makes excavation, leveling, and road construction difficult.

This map unit is in capability subclass VIIs, nonirrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

137—Tineman gravelly loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces and fans in the southeastern part of the survey area. It formed in alluvium derived dominantly from gneiss and schist. Slope is 2 to 8 percent. Elevation is 6,000 to 7,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Bearmouth and Hapgood soils. The Bearmouth soils are on old sandbars, and the Hapgood soils are in low-lying areas and in drainageways. Also included are small areas of soils that are similar to this Tineman soil but have a stony or cobbly surface layer and soils that have slopes of more than 8 percent. These soils are along intermittent drainageways. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Tineman soil is dark grayish brown gravelly loam about 7 inches thick. The upper 6 inches of the subsoil is brown very gravelly loam, and the lower 15 inches is yellowish brown very gravelly sandy clay loam. The substratum to a depth of 60 inches or more is yellowish brown very gravelly loamy sand.

Permeability is moderate. Available water capacity is about 4 inches. Effective rooting depth is about 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland.

Cropland management. This unit is suited to irrigated pasture and hay. It is limited mainly by the short growing season and droughtiness. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. This unit is poorly suited to small grain because of the short growing season and droughtiness.

Rangeland management. The potential native plant community is mainly basin wildrye, bluebunch wheatgrass, Idaho fescue, Richardson needlegrass, mountain brome, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, bluebunch wheatgrass, mountain brome, rough fescue, and Richardson

needlegrass decreases and the proportion of Idaho fescue, mountain big sagebrush, prairie junegrass, lupine, and perennial forbs increases. If overgrazing continues, plants such as annual forbs, timothy, and Kentucky bluegrass may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. This unit is poorly suited to windbreaks. It is limited by low available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. This unit is suited to homesite development. Because of the rapid permeability below a depth of about 28 inches, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

138—Tineman-Earcree complex, 4 to 25 percent slopes. This map unit is on foot slopes in Centennial Valley. Slope is 4 to 25 percent. Elevation is 7,000 to 7,500 feet. The average annual precipitation is about 20 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 40 percent Tineman cobbly loam and 40 percent Earcree sandy loam. The Tineman soil is on ridges and the upper parts of slopes, and the Earcree soil is in drainageways and on foot slopes.

Included in this unit are small areas of Hapgood soils, Rock outcrop, soils that have a stony surface layer, and sandy alluvium. The Hapgood soils are on foot slopes. The areas of Rock outcrop are on ridgetops and midslopes. The stony soils are downslope from the Rock outcrop. The areas of newly deposited sandy alluvium are along the intermittent drainageways. Included areas make up about 20 percent of the total acreage.

The Tineman soil is deep and well drained. It formed in alluvium derived from igneous rock. Typically, the surface layer is grayish brown cobbly loam about 7 inches thick. The subsoil is pale brown very cobbly loam about 14 inches thick. The upper 17 inches of the substratum is light brownish gray very cobbly sandy loam, and the lower part to a depth of 60 inches or more is yellowish brown very gravelly loamy sand.

Permeability is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Earcree soil is deep and well drained. It formed in windblown material and in alluvium. Typically, the surface layer is grayish brown sandy loam about 18 inches thick. The subsoil is pale brown sandy loam about 27 inches thick. The substratum to a depth of 60 inches or more is light brownish gray very gravelly sandy loam.

Permeability is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high.

The soils in this unit are used as rangeland. They are poorly suited to cultivated crops because of the short growing season, short slopes, and steepness of slope.

Rangeland management. The potential native plant community on the Tineman soil is mainly basin wildrye, bluebunch wheatgrass, Idaho fescue, Richardson needlegrass, mountain brome, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, bluebunch wheatgrass, mountain brome, rough fescue, and Richardson needlegrass decreases and the proportion of Idaho fescue, mountain big sagebrush, prairie junegrass, lupine, and perennial forbs increases. If overgrazing continues, plants such as annual forbs, timothy, and Kentucky bluegrass may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

The potential native plant community on the Earcree soil is mainly basin wildrye, mountain brome, Richardson needlegrass, Columbia needlegrass, bearded wheatgrass, Idaho fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, mountain brome, Richardson needlegrass, Columbia needlegrass, and bearded wheatgrass decreases and the proportion of

Idaho fescue, mountain big sagebrush, lupine, and larkspur increases. If overgrazing continues, plants such as annual bromes, onespike danthonia, timothy, and Kentucky bluegrass may invade. The potential native plant community produces about 3,200 pounds of air-dry vegetation per acre in years of above-normal precipitation and 2,500 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. The soils in this unit are very poorly suited to windbreaks because of the steepness of slope.

Homesite development. The main limitations for homesite development on the soils in this unit are slope and rapid permeability of the substratum of the Tineman soil. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Because of the rapid permeability of the Tineman soil below a depth of about 38 inches, effluent from septic tank absorption fields may contaminate ground water.

This map unit is in capability subclass VIe, nonirrigated. The Tineman soil is in Silty range site, dry, 20- to 24-inch precipitation zone, and the Earcree soil is in Sandy range site, 20- to 24-inch precipitation zone.

139—Trimad cobbly loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in intermontane valleys. It formed in gravelly and cobbly alluvium. Slope is 2 to 8 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Attewan and Beaverell soils. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Trimad soil, where mixed to a depth of 6 inches, is brown cobbly loam. The subsoil is light gray gravelly loam about 3 inches thick. The upper 9 inches of the substratum is light gray very gravelly loam, and the lower part to a depth of 60 inches or more is light brownish gray extremely gravelly sandy loam.

Permeability is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is calcareous below a depth of about 6 inches.

This unit is used mainly as rangeland. It is also used for nonirrigated and irrigated pasture and irrigated hay. It is suited to nonirrigated and irrigated small grain.

Cropland management. If this unit is used for irrigated hay and pasture, it is limited mainly by coarse fragments in the surface layer and low available water capacity. Rock fragments in the surface layer cause rapid wear of tillage equipment. Because the soil in this unit is droughty, light and frequent applications of irrigation water are needed. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition. This unit is suited to mechanical practices such as pitting and chiseling to improve areas of deteriorated rangeland. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. The high content of lime limits the choice of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It has few limitations.

This map unit is in capability subclass IIIe,

nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

140—Trimad cobbly loam, 15 to 45 percent slopes. This deep, well drained soil is on dissected upland terraces in the Madison and Ruby Valleys, in the northwestern part of the survey area. It formed in gravelly and cobbly alluvium. Slope is 15 to 45 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Amesha and Varney soils on foot slopes. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Trimad soil, where mixed to a depth of 6 inches, is brown cobbly loam. The subsoil is light gray gravelly loam about 3 inches thick. The upper 9 inches of the substratum is light gray very gravelly loam, and the lower part to a depth of 60 inches or more is light brownish gray extremely gravelly sandy loam.

Permeability is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland. It is poorly suited to cultivated crops because of slope.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, needleandthread, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and green needlegrass decreases and the proportion of western wheatgrass, needleandthread, big sagebrush, blue grama, and Sandberg bluegrass increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, and plains pricklypear may invade. The potential native plant community produces about 1,500 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition. The surface layer is subject to water erosion if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is very poorly suited to windbreaks because of the steepness of slope.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope, which is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Cutbanks are not stable and are subject to slumping. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIe, nonirrigated. It is in Thin Silty range site, 10- to 14-inch precipitation zone.

141—Trimad very stony loam, 2 to 8 percent slopes. This deep, well drained soil is on fans and terraces in Madison Valley, in the northwestern part of the survey area. It formed in gravelly and stony alluvium. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of nonstony Attewan and Beaverell soils that occur in an irregular pattern throughout the unit. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Trimad soil is dark grayish brown very stony loam about 2 inches thick. The subsoil is brown gravelly loam about 7 inches thick. The upper 9 inches of the substratum is light gray very gravelly loam, and the lower part to a depth of 60 inches or more is light brownish gray extremely gravelly sandy loam.

Permeability is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This unit is used as rangeland. It is not suited to cultivated crops because of the very stony surface layer.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber

rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Use of mechanical treatment practices is not practical. This unit is not suited to seeding because of the high content of stones in the surface layer.

Windbreak management. This unit is very poorly suited to windbreaks because of the high content of stones in the surface layer.

Homesite development. The main limitation for homesite development on this unit is stoniness. Stoniness makes excavation, leveling, and road construction difficult.

This map unit is in capability subclass VIIs, nonirrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

142—Trimad-Kalsted complex, 8 to 45 percent slopes. This map unit is on hills and dissected terraces in uplands in the northwestern part of the survey area. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

This unit is about 60 percent Trimad cobbly loam and 30 percent Kalsted sandy loam. The Trimad soil is on ridgetops and the upper part of slopes. The strongly sloping Kalsted soil is on foot slopes and in intermittent drainageways.

Included in this unit are small areas of sandy, gravelly, or very gravelly soils that formed in recent alluvium. These soils are mainly in drainageways. Included areas make up about 10 percent of the total acreage.

The Trimad soil is deep and well drained. It formed in gravelly and cobbly alluvium. Typically, the surface layer is dark grayish brown cobbly loam about 2 inches thick. The subsoil is brown cobbly loam about 7 inches thick. The upper 9 inches of the substratum is light gray very gravelly loam, and the lower part to a depth of 60 inches or more is light brownish gray extremely gravelly sandy loam.

Permeability of the Trimad soil is moderate to a depth of about 18 inches and moderately rapid below this depth. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate. This soil is calcareous below a depth of about 6 inches.

The Kalsted soil is deep and well drained. It formed in calcareous alluvium and eolian material. Typically, the surface layer is gray sandy loam about 4 inches thick. The underlying material to a depth of 60 inches or more is light gray sandy loam.

Permeability of the Kalsted soil is moderately rapid. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is calcareous throughout.

The soils in this unit are used as rangeland. They are poorly suited to cultivated crops because of slope.

Rangeland management. The potential native plant community on the Trimad soil is mainly bluebunch wheatgrass, green needlegrass, western wheatgrass, needleandthread, and big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and green needlegrass decreases and the proportion of western wheatgrass, needleandthread, big sagebrush, blue grama, and Sandberg bluegrass increases. If overgrazing continues, plants such as rubber rabbitbrush, broom snakeweed, and plains pricklypear may invade. The potential native plant community produces about 1,500 pounds of air-dry vegetation per acre in years of above-normal precipitation and 700 pounds in years of below-normal precipitation.

The potential native plant community on the Kalsted soil is mainly bluebunch wheatgrass, Indian ricegrass, prairie sandreed, needleandthread, thickspike wheatgrass, skunkbush sumac, and common snowberry. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, Indian ricegrass, and prairie sandreed decreases and the proportion of needleandthread, threadleaf sedge, prairie junegrass, blue grama, thickspike wheatgrass, skunkbush sumac, and common snowberry increases. If overgrazing continues, plants such as broom snakeweed, plains pricklypear, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 1,900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

The surface layer of the soils in this unit is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed. Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range

vegetation is in poor condition.

Windbreak management. The soils in this unit are very poorly suited to windbreaks. They are limited mainly by steepness of slope.

Homesite development. The main limitation for homesite development on the soils in this unit is slope. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

This map unit is in capability subclass VIe, nonirrigated. The Trimad soil is in Thin Silty range site, 10- to 14-inch precipitation zone, and the Kalsted soil is in Sandy range site, 10- to 14-inch precipitation zone.

143—Trudau loam, 2 to 8 percent slopes. This deep, well drained soil is on fans, foot slopes, and terraces in the western part of the survey area. It formed in alluvium derived from sandstone, siltstone, and shale. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Varney and Amesha soils. The Varney soils are on low hills, and the Amesha soils are along intermittent drainageways. Also included are small areas of soils that have a dense clay loam subsoil. These soils are in depressional areas and are strongly sodium-affected. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Trudau soil is light gray loam 2 inches thick. The upper 12 inches of the subsoil is light gray loam, and the lower 16 inches is very pale brown loam. The substratum to a depth of 60 inches or more is very pale brown loam and strata of sandy loam. In some areas the surface layer is clay loam.

Permeability is moderately slow. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 14 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is slightly sodium-affected and moderately salt-affected. It is calcareous throughout.

This unit is used as rangeland. It is poorly suited to use as cropland because of the moderate salinity. If the soil in this unit is reclaimed and drained, it is suited to irrigated crops such as small grain and alfalfa.

Rangeland management. The potential native plant community is mainly western wheatgrass, green needlegrass, greasewood, inland saltgrass, basin wildrye, rubber rabbitbrush, and horsebrush. If the range is excessively grazed, the proportion of western wheatgrass, green needlegrass, and basin wildrye decreases and the proportion of greasewood, inland saltgrass, Sandberg bluegrass, rubber rabbitbrush, and horsebrush increases. If overgrazing continues, plants such as foxtail barley, Belvedere summercypress, and annual bromes may invade. The potential native plant community produces about 1,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 300 pounds in years of below-normal precipitation.

This unit is very poorly suited to seeding because of the high content of salts, which reduces seedling survival. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is moderately salt-affected, which limits the choice of trees and shrubs to Russian olive and silver buffaloberry.

Homesite development. The main limitations for homesite development on this unit are the moderately slow permeability, the potential for shrinking and swelling, low soil strength, and frost action potential. If the soil in this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. Shrinking and swelling, frost action, and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass VIe, nonirrigated. It is in Saline Upland range site, 10- to 14-inch precipitation zone.

144—Trudau loam, slightly saline, 2 to 8 percent slopes. This deep, well drained soil is on fans, foot slopes, and terraces in the western part of the survey area. It formed in alluvium derived from sandstone, siltstone, and shale. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of Varney and Amesha soils. The Varney soils are on low hills. The Amesha soils are along intermittent drainageways. Also included are small areas of depressional soils that have

a slowly permeable, dense clay subsoil. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Trudau soil, where mixed to a depth of 7 inches, is pale brown loam. The subsoil is very pale brown loam about 20 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam and strata of sandy loam.

Permeability is moderately slow. Available water capacity is about 9 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is slightly sodium- and salt-affected. It is calcareous throughout.

Most areas of this unit are used for irrigated crops, mainly alfalfa, grass for pasture, and small grain. A few areas are used as rangeland.

Cropland management. If this unit is used for irrigated crops, it is limited by the hazards of soil blowing and water erosion and by salinity. The surface layer is high in content of lime and low in content of organic matter. Crops respond well to the application of phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Minimum tillage, stubble mulch tillage, contour stripcropping, and using tall grass barriers and field windbreaks help to reduce soil blowing. Minimum tillage, contour stripcropping, and using grassed waterways reduce runoff and water erosion. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Flood irrigation is suited to this unit if contour ditches are used. Good irrigation water management is necessary to keep salts leached from the root zone.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, needleandthread, big sagebrush, and winterfat. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is suited to windbreaks. Suitable trees for planting are Russian olive, Siberian crabapple, green ash, Siberian elm, blue spruce, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, lilac, Tatarian honeysuckle, and western sandcherry. If irrigated, this unit is also suited to cottonwood and golden willow trees.

Homesite development. The main limitations for homesite development on this unit are the moderately slow permeability, the potential for shrinking and swelling, low soil strength, and frost action potential. If the soil in this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. Shrinking and swelling, frost action, and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

145—Ustic Torriorthents, gently sloping. These soils consist of dredge tailings on stream bottoms, mainly east of Alder. Elevation is 4,500 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

These Ustic Torriorthents are deep and excessively drained. They formed in stream alluvium during placer mining operations. These soils are extremely gravelly and cobbly sand to a depth of 60 inches or more.

Permeability is very rapid. Available water capacity is less than 2 inches. In some areas a seasonal high water table is between depths of 36 and 72 inches from late in winter to early in spring. These soils are rarely flooded in spring.

Some areas of this unit are used for grazing. The unit is also used as wildlife habitat and as recreation and watershed areas.

Rangeland management. The native plant community is mainly cottonwood and juniper with a sparse understory of grasses and shrubs. The soils in this unit are very poorly suited to seeding because of the high content of stones and cobbles in the surface layer and the very low available water capacity.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by droughtiness.

Homesite development. Because the soils in this unit are very rapidly permeable, effluent from septic tank absorption fields may contaminate ground water. Sites for homes and septic tank absorption fields should be thoroughly investigated before beginning construction. The seasonal high water table and the rare periods of flooding may also limit homesite development.

This map unit is in capability subclass VIs, nonirrigated.

146—Ustic Torriorthents, hilly. These soils consist of deep, excessively drained dredge tailings in stream bottoms, mainly upstream from Alder. Elevation is 4,500 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

These Ustic Torriorthents formed during placer mining operations. They formed in stream alluvium of mixed mineralogy. These soils are extremely gravelly and cobbly sand. Many small ponds are between the piles of dredge material. Cottonwood trees, willows, cattails, and sedges commonly surround these ponds.

Permeability is very rapid. Available water capacity is less than 2 inches. Surface runoff is slow.

This unit is used as wildlife habitat and as recreation and watershed areas. Waterfowl and muskrat, as well as brook trout, make use of some of the included ponds. This unit is not suited to agriculture, and it supports little native vegetation.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited mainly by steepness of slope and droughtiness.

Homesite development. This unit is poorly suited to homesite development. It is limited mainly by slope and the high content of coarse fragments.

This map unit is in capability subclass VIIs, nonirrigated.

147—Varney clay loam, 2 to 8 percent slopes. This deep, well drained soil is on terraces, fans, and foot slopes in the Madison and Ruby Valleys. It formed in alluvium. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of clayey soils. Also included are small areas of Rock outcrop and soils that have a cobbly surface layer. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Varney soil is grayish brown clay loam 5 inches thick. The subsoil is brown clay loam about 11 inches thick. The upper 12 inches of the substratum is light gray gravelly sandy clay loam, the next 20 inches is very pale brown gravelly sandy loam, and the lower part to a depth of 60 inches or more is mainly light brown gravelly sandy loam and gravelly loamy sand. In some areas the surface layer is gravelly clay loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. It is also used for irrigated and nonirrigated crops. The main irrigated crops are alfalfa and grass for hay and grass for pasture. Small grain is also grown. The main nonirrigated crops are grass for pasture and small grain.

Cropland management. If this unit is used for cultivated crops, it is limited by the hazards of water erosion and soil blowing. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Contour ditch irrigation is also suited to this unit. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. On long slopes, chiseling the stubble in fall, either on the contour or across the slope, slows runoff and reduces soil loss in years when the snow melts rapidly while the soil is still frozen. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big

sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks; however, the limited available water capacity restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by the moderate permeability, the potential for shrinking and swelling, and low soil strength. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Shrinking and swelling and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations.

This map unit is in capability subclass IIIe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

148—Varney clay loam, 8 to 15 percent slopes. This deep, well drained soil is on dissected terraces, fans, and foot slopes in Madison and Ruby Valleys. It formed in alluvium. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of clayey soils, Rock outcrop, and soils that have a cobbly surface layer. Also included are small areas of soils that have slopes of less than 8 percent, a few areas of soils that have slopes of more than 15 percent, and, in areas north of Norris, soils that have a light-colored, highly calcareous plow layer. Included soils make up about 15 percent of the total acreage.

Typically, the surface layer of this Varney soil is grayish brown clay loam 5 inches thick. The subsoil is brown gravelly clay loam about 11 inches thick. The upper 12 inches of the substratum is light gray gravelly sandy clay loam, the next 20 inches is pale brown gravelly sandy loam, and the lower part to a depth of 60 inches or more is light brownish gray gravelly loamy sand with thin strata of gravelly loam. In a few areas in the vicinity of Virginia City, the surface layer is very channery clay loam.

Permeability is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 15 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. It is also used for hay and irrigated and nonirrigated cultivated crops. The main irrigated crops are alfalfa and grass for hay and grass for pasture. Small grain is also grown. The main nonirrigated crops are grass for pasture and small grain.

Cropland management. If this unit is used for cultivated crops, it is limited by the hazards of water erosion and soil blowing. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Suitable practices for reducing soil blowing and water erosion are stripcropping; using tall grass barriers, field windbreaks, and grassed waterways; minimum tillage; and stubble mulch tillage. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Growing grasses and legumes for hay and pasture also reduces soil blowing, runoff, and water erosion.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. This unit is suited to windbreaks. It has limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, Tatarian honeysuckle, skunkbush sumac, and silver buffaloberry. If irrigated, this unit is also suited to lilac shrubs and blue spruce trees.

Homesite development. This unit is suited to homesite development. It is limited mainly by slope, moderate permeability, the potential for shrinking and swelling, and low soil strength. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Shrinking and swelling and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Excavation for roads can expose material that is highly susceptible to water erosion. Making low gradient cuts and fills and establishing a suitable plant cover reduce water erosion.

This map unit is in capability subclass IVe, nonirrigated and irrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

149—Varney cobbly clay loam, 8 to 45 percent slopes. This deep, well drained soil is on terrace escarpments, in drainageways, and on hills in Madison and Ruby Valleys. It formed in alluvium. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Trimad, Amesha, and Blackhall soils. Also included are small areas of clayey soils. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Varney soil is grayish brown cobbly clay loam about 5 inches thick. The subsoil is brown cobbly clay loam about 11 inches thick. The upper 32 inches of the substratum is pale brown and white gravelly sandy loam, and the lower part to a depth of 60 inches or more is light brownish gray gravelly loamy sand with thin strata of gravelly loam.

Permeability is moderate. Available water capacity is about 6 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 12 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. It is not suited to cultivated crops because of the short slopes and steepness of slope.

Rangeland management. The potential native plant community is mainly bluebunch wheatgrass, green needlegrass, winterfat, big sagebrush, and needleandthread. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass, green needlegrass, and winterfat decreases and the proportion of needleandthread, prairie junegrass, big sagebrush, and blue grama increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, plains pricklypear, and annual bromes may invade. The potential native plant community produces about 2,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,000 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock and promotes overgrazing of the less sloping areas. Use of mechanical treatment is not practical because of short slopes and steepness of slope.

Windbreak management. This unit is very poorly suited to windbreaks because of the steepness of slope.

Homesite development. If this unit is used for homesite development, it is limited mainly by slope, moderate permeability, frost action potential, potential for shrinking and swelling, and low soil strength. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Shrinking and swelling, frost action, and low soil strength can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome these limitations. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIIe, nonirrigated. It is in Silty range site, 10- to 14-inch precipitation zone.

150—Villy silty clay loam, cool, 0 to 2 percent slopes. This deep, poorly drained soil is on the bottoms of drainageways and on low terraces in the Ruby Valley. It is occasionally flooded and has a seasonal high water table at a depth of 12 to 20 inches. This soil

formed in stratified alluvium. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Havre and Ryell soils and deep sandy loam. Also included are soils in narrow swales and old stream meander channels. Many of these areas are filled with water during spring and carry runoff from adjacent irrigated areas. Included areas make up about 10 percent of the total acreage

Typically, the surface layer of this Villy soil is light gray silty clay loam 10 inches thick. The upper 11 inches of the underlying material is light gray silty clay loam, the next 21 inches is dark gray silty clay loam, and the lower part to a depth of 60 inches or more is gray very fine sandy loam.

Permeability is moderately slow. Available water capacity is about 11 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table fluctuates between depths of 12 and 20 inches from May through August. This soil is subject to occasional, brief periods of flooding during March and April. It is calcareous throughout.

This unit is used as rangeland. It is poorly suited to cropland because of the high water table during the growing season. If drained, this unit is suited to irrigated crops such as small grain and alfalfa and grass for hay.

Rangeland management. The potential native plant community is mainly tall reedgrass, slough sedge, tufted hairgrass, slender wheatgrass, Nebraska sedge, shrubby cinquefoil, and Douglas hawthorn. If the rangeland is overgrazed, the proportion of tall reedgrass, tufted hairgrass, slender wheatgrass, and Nebraska sedge decreases and the proportion of bluegrasses, slough sedge, shrubby cinquefoil, and Douglas hawthorn increases. If overgrazing continues, plants such as Kentucky bluegrass, Rocky Mountain iris, Baltic rush, and foxtail barley may invade. The potential native plant community produces about 5,000 pounds of air-dry vegetation per acre in years of above-normal precipitation and 3,000 pounds in years of below-normal precipitation.

Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Use of mechanical equipment to improve forage production may be limited by wetness except in fall. Areas near irrigated land are driest late in spring.

Windbreak management. This unit is very poorly suited to windbreaks. It is limited by wetness.

Homesite development. This unit is poorly suited to homesite development because of the occasional, brief periods of flooding. It is also limited by the seasonal high water table. The moderately slow permeability and the seasonal high water table increase the possibility of failure of septic tank absorption fields.

This map unit is in capability subclass VIw, nonirrigated. It is in Subirrigated range site, 10- to 14-inch precipitation zone.

151—Villy silty clay loam, cool, drained, 0 to 2 percent slopes. This deep, poorly drained soil is on bottoms of drainageways and on low terraces in Ruby Valley. It formed in stratified alluvium. Elevation is 4,200 to 6,000 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small, randomly distributed areas of Havre and Ryell soils and deep sandy loam. Also included are narrow swales and old stream meander channels. Many of these are filled with water during spring runoff. Also included is an area of soils that have a clayey surface layer. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Villy soil is light gray silty clay loam 10 inches thick. The upper 11 inches of the underlying material is light gray silty clay loam, the next 21 inches is dark gray silty clay loam, and the lower part to a depth of 60 inches or more is gray very fine sandy loam.

Permeability is moderately slow. Available water capacity is about 11 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. A seasonal high water table fluctuates between depths of 36 and 60 inches from May through August. This soil is subject to rare, brief periods of flooding during March and April. It is calcareous throughout.

This unit is used for irrigated crops, mainly alfalfa and grass for hay and pasture and small grain.

Cropland management. If this unit is used for irrigated crops, it is limited by the hazard of soil blowing. Suitable methods for reducing soil blowing are stripcropping, using tall grass barriers and field windbreaks, minimum tillage, and stubble mulch tillage. The surface layer is high in content of lime and low in

content of organic matter. Crops respond well to the application of phosphorus and nitrogen. Using green manure crops, barnyard manure, and crop residue increases organic matter content and fertility. Sprinkler irrigation is the most suitable method of applying water. Border irrigation is also suited to this unit. Leveling is needed for the efficient application and removal of irrigation water. Growing grass and legumes for hay and pasture reduces soil blowing.

Windbreak management. This unit is very poorly suited to windbreaks. The seasonal high water table limits the choice of trees and shrubs to those that are water tolerant. Suitable trees for planting are cottonwood, golden willow, white willow, Russian olive, Siberian elm, Siberian crabapple, blue spruce, and Rocky Mountain juniper. Suitable shrubs are purpleosier willow, common chokecherry, lilac, and silver buffaloberry.

Homesite development. This unit is poorly suited to homesite development because of the rare periods of flooding. The moderately slow permeability and the seasonal high water table increase the possibility of failure of septic tank absorption fields.

This map unit is in capability subclass IVw, irrigated.

152—Whitecow-Rock outcrop complex, 25 to 70 percent slopes. This map unit is on south-facing slopes in the mountainous parts of the survey area. Elevation is 6,000 to 8,000 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 90 days.

This unit is about 50 percent Whitecow extremely channery loam and 25 percent Rock outcrop.

Included in this unit are small areas of dark-colored soils, shallow soils, and clayey soils. The dark-colored soils are at the base of slopes and support a dense cover of grass suitable for use as forage. The shallow soils generally are adjacent to the areas of Rock outcrop. These soils are barren or nearly barren of vegetation. The clayey soils are in areas of interbedded shale outcrops. Included areas make up about 25 percent of the total acreage.

The Whitecow soil is deep and well drained. It formed in colluvium derived dominantly from limestone. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light brownish gray extremely channery loam about 9 inches thick. The subsoil is light gray very channery loam about 11 inches thick. The substratum to a depth of 60 inches or more is light gray extremely channery loam.

Permeability of the Whitecow soil is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 30 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is high. This soil is calcareous throughout.

The Rock outcrop consists of exposures of limestone.

The soil in this unit is used as rangeland. The forest overstory has limited commercial value.

Rangeland management. The potential native forest understory on the Whitecow soil is mainly bluebunch wheatgrass, Idaho fescue, arrowleaf balsamroot, common juniper, and whortleleaf snowberry. Overgrazing can encourage an increase in the forest canopy and reduce the cover of desirable forage plants. The understory produces about 300 pounds of air-dry vegetation per acre in years of above-normal precipitation and 100 pounds in years of below-normal precipitation.

Steepness of slope and the areas of Rock outcrop limit access by livestock.

Forest management. The Whitecow soil is suited to Douglas fir. It is limited mainly by the low available water capacity and steepness of slope. The site index for Douglas fir is 22. The potential annual production (CMAI) per acre is about 30 cubic feet or 70 board feet (Scribner rule). Potential production is for an even-aged, fully stocked stand of trees.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe. It is in woodland suitability group 2R.

153—Whitore complex, 15 to 45 percent slopes. This map unit is on mountainsides, fans, and moraines in the mountainous parts of the survey area. It formed in colluvium and glacial till derived from limestone and calcareous sandstone. Elevation is 6,000 to 8,500 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

This unit is about 60 percent Whitore channery loam and 30 percent Whitore stony loam.

Included in this unit are small areas of Hanson and Mikesell soils. The Hanson soils are in grassy parks, on foot slopes, and in drainageways. The Mikesell soils are randomly distributed throughout the unit. These soils provide most of the limited grazeable understory

available in this unit. Included areas make up about 10 percent of the total acreage.

The Whitore channery loam is deep and well drained. Typically, the surface of this Whitore soil is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is dark grayish brown channery loam about 5 inches thick. The subsoil is pale brown channery loam about 7 inches thick. The substratum to a depth of 60 inches or more is light gray and white very channery and extremely channery loam.

Permeability is moderate. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 60 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Whitore stony loam is deep and well drained. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is dark grayish brown stony loam about 5 inches thick. The subsoil is pale brown stony loam about 7 inches thick. The substratum to a depth of 60 inches or more is light gray very flaggy loam.

Permeability is moderate. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 60 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory on the soils in this unit is mainly common juniper, mallow ninebark, common snowberry, Oregongrape, and white spirea. The understory produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation. Steepness of slope limits access by livestock.

Forest management. The soils in this unit are suited to Douglas fir. The site index for Douglas fir is 37. The potential annual production (CMAI) per acre is about 50 cubic feet or 150 board feet (Scribner rule). Potential production is for an even-aged, fully stocked stand of trees.

The main limitations for timber management on the soils in this unit are slope and low available water capacity. Steepness of slope limits the kinds of equipment that can be used. The understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard if the soils are disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. If this unit is used for roads, it is limited mainly by slope and the hazard of water erosion and stoniness of the Whitore stony loam. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads. Stoniness makes excavation, leveling, and road construction difficult.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe. It is in woodland suitability group 3R.

154—Whitore-Mikesell, warm-Rock outcrop complex, 25 to 60 percent slopes. This map unit is on mountainsides. Elevation is 6,500 to 8,500 feet. The average annual precipitation is about 26 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

This unit is about 40 percent Whitore very channery clay loam, 30 percent Mikesell clay loam, and 20 percent Rock outcrop. The Whitore soil is on side slopes and ridges, the Mikesell soil is in swales and drainageways, and the Rock outcrop is on cliffs, ledges, and ridgetops.

Included in this unit are small areas of Worock soils and soils that are shallow to shale, sandstone, and limestone. The shallow soils are on ridgetops adjacent to the areas of Rock outcrop. Also included are areas of talus that are below the areas of Rock outcrop. Included areas make up about 10 percent of the total acreage.

The Whitore soil is deep and well drained. It formed in colluvium derived from limestone and strongly calcareous sandstone. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light brownish gray very channery clay loam about 6 inches thick. The subsoil is light gray very channery clay loam about 16 inches thick. The substratum to a depth of 60 inches or more is light gray very channery loam.

Permeability of the Whitore soil is moderate. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 60 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Mikesell soil is deep and well drained. It formed in material derived from shale. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light brownish gray clay loam about 8 inches thick. The upper 6 inches of the subsoil is very pale brown clay, and the lower part to a depth of 60 inches or more is brown shaly clay.

Permeability of the Mikesell soil is slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Rock outcrop is mainly exposures of limestone and calcareous sandstone. These areas are barren of vegetation, except for a few trees and shrubs growing in fractures.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory on the Whitore soil is mainly common juniper, mallow ninebark, common snowberry, Oregongrape, and white spirea. The understory produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation.

The potential native forest understory on the Mikesell soil is mainly mallow ninebark, Oregongrape, pinegrass, and white spirea. The understory produces about 900 pounds of air-dry vegetation per acre in years of above-normal precipitation and 500 pounds in years of below-normal precipitation.

Steepness of slope and the areas of Rock outcrop limit access by livestock. Trails or walkways can be constructed to encourage livestock grazing in areas where access is limited.

Forest management. The Whitore soil is suited to Douglas fir. The site index for Douglas fir is 37. The potential annual production (CMAI) per acre is about 50 cubic feet or 150 board feet (Scribner rule). Potential production is for an even-aged, fully stocked stand of trees.

The Mikesell soil is suited to Douglas fir and lodgepole pine. The site index is 40 for Douglas fir and 57 for lodgepole pine. The potential annual production (CMAI) per acre is about 50 cubic feet or 160 board feet (Scribner rule) for Douglas fir and 50 cubic feet or 145 board feet for lodgepole pine. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates were not made for lodgepole pine.

Timber management on this unit is limited by slope, the moderate available water capacity of the Whitore soil, and the content of clay in the Mikesell soil. Steepness of slope and the clayey texture of the Mikesell soil limit the kind of equipment that can be used, the ease of operation, and the time of use. The Mikesell soil has low strength when wet, which results in poor trafficability and the possibility of soil compaction when heavy equipment is used to yard logs. Operating equipment only when the soil is dry or frozen can overcome this limitation. Track-type tractors can be used effectively on most slopes; however, line skidding should be considered for use in the steeper areas. Water erosion is a hazard if the soils are disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation. The understory vegetation competes vigorously with tree seedlings. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. The Mikesell soil has a high potential for mass soil movement.

Roads. If the soils in this unit are used for roads, they are limited mainly by slope, low soil strength, shrink-swell potential, and potential for frost action. The areas of Rock outcrop make road construction difficult and limit accessibility to some areas. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads. The low strength of the soil when wet, shrinking and swelling, frost action in the Mikesell soil, and steepness of slope adversely affect road performance and soil stability.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIe. The Whitore soil is in woodland suitability group 3R, and the Mikesell soil is in woodland suitability group 4R.

155—Whitore-Rock outcrop complex, 25 to 70 percent slopes. This map unit is on mountainsides and ridges in the mountainous parts of the survey area. Elevation is 6,000 to 8,500 feet. The average annual precipitation is about 24 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

This unit is about 50 percent Whitore channery loam, 30 percent Whitore stony loam, and 15 percent Rock outcrop. The Whitore soils are on mountainsides, and the Rock outcrop is on ridges.

Included in this unit are small areas of Hanson and

Mikesell soils. The Hanson soils are in grassy parks on ridgetops and foot slopes and in drainageways. The Mikesell soils are near areas of shale bed outcroppings. These soils provide most of the limited forest understory grazing available in the unit. Included areas make up about 5 percent of the total acreage.

The Whitore channery loam is deep and well drained. It formed in colluvium derived from limestone. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is dark grayish brown channery loam about 3 inches thick. The subsoil is pale brown channery loam about 9 inches thick. The substratum to a depth of 60 inches or more is light gray and white very channery loam and extremely channery loam.

Permeability of this Whitore soil is moderate. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 60 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Whitore stony loam is deep and well drained. It formed in colluvium derived from limestone. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is dark grayish brown stony loam about 5 inches thick. The subsoil is pale brown channery loam about 7 inches thick. The substratum to a depth of 60 inches or more is light gray very flaggy loam.

Permeability of this Whitore soil is moderate. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 60 inches. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Rock outcrop is massive limestone.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory on the Whitore soils in this unit is mainly common juniper, mallow ninebark, common snowberry, Oregongrape, and white spirea. The understory produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation. Steepness of slope limits access by livestock.

Forest management. The Whitore soils in this unit are suited to Douglas fir. The site index for Douglas fir is 37. The potential annual production (CMAI) per acre is about 50 cubic feet or 150 board feet (Scribner rule). Potential production is for an even-aged, fully stocked stand of trees.

The main limitations for timber management on these soils are slope and moderate available water capacity. Steepness of slope limits the kinds of equipment that can be used. Track-type tractors can be used effectively on most slopes; however, line skidding should be considered for use in the steeper areas. The understory vegetation competes with tree seedlings for the limited amount of available water. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Water erosion is a hazard if the soils are disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation.

Roads. If this unit is used for roads, it is limited mainly by slope, the hazard of water erosion, the areas of Rock outcrop, and stoniness. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads. Stoniness makes excavation, leveling, and road construction difficult. The areas of Rock outcrop make road construction difficult and limit accessibility to some areas.

Homesite development. This unit is poorly suited to homesite development because of the steepness of slope and the areas of Rock outcrop.

This map unit is in capability subclass VIIe. It is in woodland suitability group 3R.

156—Woodhall gravelly loam, 4 to 15 percent slopes. This moderately deep, well drained soil is on broad hills and ridges of uplands in the central and southeastern parts of the survey area. It formed in material derived from igneous rock. Elevation is 7,000 to 8,000 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

Included in this unit are small areas of Adel, Leavitt, and Hapgood soils at the base of slopes and in small depressional areas. Also included are small, randomly distributed areas of soils that have bedrock at a depth of less than 20 inches, Rock outcrop, and stony soils. Included areas make up about 15 percent of the total acreage.

Typically, the surface layer of this Woodhall soil is very dark gray gravelly loam about 10 inches thick. The upper 12 inches of the subsoil is brown very gravelly clay loam, and the lower 8 inches is pale brown very stony loam. Basalt is at a depth of 30 inches.

Permeability is moderate. Available water capacity is about 3 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 25 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. Basalt is at a depth of 20 to 40 inches.

This unit is used as rangeland.

Cropland management. This unit is suited to irrigated pasture and hay. It is limited mainly by the short growing season and droughtiness. It is also limited by the hazards of soil blowing and water erosion and by runoff when the soil is tilled for seedbed preparation and planting. Farming on the contour or across the slope, where practical, reduces runoff and water erosion. Soil blowing can be reduced by using the residue from the previous crop. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. This unit is poorly suited to small grain because of the short growing season and droughtiness.

Rangeland management. The potential native plant community is mainly basin wildrye, Richardson needlegrass, Idaho fescue, mountain brome, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of basin wildrye, Richardson needlegrass, mountain brome, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and other perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition.

Windbreak management. This unit is poorly suited to windbreaks. It has very limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, the unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees.

Homesite development. If this unit is used for homesite development, it is limited mainly by the moderate depth to bedrock. The deep cuts needed to provide essentially level building sites can expose bedrock. The unit is severely limited for septic tank absorption fields because of the moderate depth to bedrock. Fractures in the bedrock at a depth of 20 to 40 inches allow effluent to percolate through the bedrock to ground water supplies. Increasing the size of the absorption area may reduce such percolation.

This map unit is in capability subclass VIe, nonirrigated and irrigated. It is in Silty range site, dry, 20- to 24-inch precipitation zone.

157—Woodhall-Blaine-Hapgood complex, 4 to 25 percent slopes. This map unit is on broad hills and ridges in the southeastern and central parts of the survey area. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 75 days.

This unit is about 40 percent Woodhall stony loam, 40 percent Blaine stony loam, and 10 percent Hapgood gravelly loam. The Woodhall soil is on broad ridgetops and north-facing hillsides, the Blaine soil is in the drier areas on narrow ridgetops and south-facing hillsides, and the Hapgood soil is in the moister areas on north-facing hillsides and in drainageways and swales.

Included in this unit are small areas of Hapgood stony loam and Sebud and Tiban soils. The Hapgood stony loam is in swales and depressional areas and on north-facing side slopes. The Sebud and Tiban soils are on deep, colluvial foot slopes. Also included are small areas of Rock outcrop on narrow ridgetops and hillsides and poorly drained soils along narrow stream bottoms and in spring areas. Included areas make up about 10 percent of the total acreage.

The Woodhall soil is moderately deep and well drained. It formed in stony material derived from igneous bedrock. Typically, the surface layer is very dark gray stony loam about 10 inches thick. The upper part of the subsoil is brown very stony clay loam about 12 inches thick, and the lower part is pale brown very stony loam about 8 inches thick. Basalt is at a depth of 30 inches. Depth to basalt is 20 to 40 inches.

Permeability of the Woodhall soil is moderate. Available water capacity is about 3 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 25 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Blaine soil is moderately deep and well drained. It formed in material derived from igneous bedrock. Typically, the surface layer is brown stony loam about 6

inches thick. The upper part of the subsoil is dark yellowish brown very stony clay loam about 4 inches thick, and the lower part is yellowish brown very stony loam about 9 inches thick. The substratum is pale brown extremely stony loam about 6 inches thick over fractured igneous bedrock. Depth to bedrock is 20 to 40 inches.

Permeability of the Blaine soil is moderate. Available water capacity is about 2 inches. Effective rooting depth is 20 to 40 inches. Where this soil is under native vegetation, the average annual wetting depth is about 25 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Hapgood soil is deep and well drained. It formed in colluvium derived from igneous rock. Typically, the surface layer is very dark grayish brown gravelly loam about 18 inches thick. The underlying material to a depth of 60 inches or more is grayish brown very gravelly loam.

Permeability of the Hapgood soil is moderate. Available water capacity is about 7 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as rangeland. They are very poorly suited to cultivated crops because of the large stones in the surface layer, the short growing season, and slope.

Rangeland management. The potential native plant community on the Woodhall and Hapgood soils is mainly mountain brome, Richardson needlegrass, basin wildrye, Idaho fescue, bluebunch wheatgrass, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of mountain brome, Richardson needlegrass, basin wildrye, bluebunch wheatgrass, and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, lupine, and perennial forbs increases. If overgrazing continues, plants such as timothy, Kentucky bluegrass, and annual forbs may invade. The potential native plant community produces about 2,800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,600 pounds in years of below-normal precipitation.

The potential native plant community on the Blaine soil is mainly bluebunch wheatgrass, Idaho fescue, rough fescue, and mountain big sagebrush. If the rangeland is overgrazed, the proportion of bluebunch wheatgrass and rough fescue decreases and the proportion of Idaho fescue, mountain big sagebrush, thickspike wheatgrass, lupine, and prairie junegrass increases. If overgrazing continues, plants such as onespike danthonia, Kentucky bluegrass, and wyethia may invade. The potential native plant community produces about 2,600 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,500 pounds in years of below-normal precipitation.

In places, brush control improves production of desirable forage plants. The soils in this unit are poorly suited to mechanical treatment because of the stones in the surface layer.

Windbreak management. The soils in this unit are very poorly suited to windbreaks because of the steepness of slope and the droughtiness of the Woodhall and Blaine soils.

Homesite development. The soils in this unit are poorly suited to homesite development because of steepness of slope and the moderate depth to bedrock in the Woodhall and Blaine soils.

This map unit is in capability subclass VIs, nonirrigated. The Woodhall and Hapgood soils are in Silty range site, dry, 20- to 24-inch precipitation zone, and the Blaine soil is in Silty range site, 15- to 19-inch precipitation zone.

158—Worock gravelly sandy loam, 8 to 35 percent slopes. This deep, well drained soil is on upland terraces and mountainsides in the southeastern part of the survey area. It formed in colluvium and alluvium derived dominantly from welded tuff. Elevation is 6,000 to 7,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

Included in this unit are small areas of Shadow and Hapgood soils and soils that have a very stony surface layer. The Shadow soils and the very stony soils formed in a thin layer of welded tuff over alluvium or bedrock. They are in drainageways. The Hapgood soils support a stand of grass and are in drainageways and swales. Included areas make up about 15 percent of the total acreage.

Typically, the surface of the Worock soil is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light brownish gray gravelly sandy loam about 14 inches thick. The upper 14 inches of the subsoil is pale brown very gravelly sandy clay loam, and the lower part to a depth of 60 inches or more is very gravelly clay loam.

Permeability is moderately slow. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native

vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as woodland and for understory grazing.

Rangeland management. The potential native forest understory is mainly grouse whortleberry, blue huckleberry, white spirea, and silvery lupine. The understory produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation.

Forest management. This unit is suited to lodgepole pine, Douglas fir, Engelmann spruce, and subalpine fir. The site index is 64 for lodgepole pine, 57 for Douglas fir, and 77 for Engelmann spruce. The potential annual production (CMAI) per acre is about 60 cubic feet or 180 board feet (Scribner rule) for lodgepole pine, 80 cubic feet or 290 board feet for Douglas fir, and 70 cubic feet or 320 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

This unit has few limitations for timber management. The understory vegetation competes with tree seedlings. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Windthrow can be a hazard during periods of soil wetness and high winds.

Roads. If this unit is used for roads, it is limited mainly by slope. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads.

Homesite development. The main limitations for homesite development on this unit are slope, the moderately slow permeability, the potential for shrinking and swelling, and potential for frost action. If the soil in this unit is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field or by excavating the trench to a suitable depth. The field or trench should be backfilled with gravel. The steepness of slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Shrinking and swelling and frost action can adversely affect the quality of roadbeds and road surfaces. Adequate drainage and the use of suitable fill material that is properly compacted can overcome this limitation.

This map unit is in capability subclass VIe, nonirrigated. It is in woodland suitability group 5R.

159—Worock-Mikesell complex, 15 to 45 percent slopes. This map unit is on glacial moraines in the mountainous parts of the survey area. Elevation is 6,500 to 7,500 feet. The average annual precipitation is about 30 inches, the average annual air temperature is about 38 degrees F, and the average frost-free period is about 45 days.

This unit is about 50 percent Worock very stony loam and 40 percent Mikesell clay loam. The Worock soil is mainly on the tops and sides of hills, and the Mikesell soil is on hillsides and foot slopes.

Included in this unit are small areas of Shadow and Loberg soils. Also included are small areas of wet soils and very stony or bouldery soils. The Shadow soils are on the tops and sides of hills. The Loberg soils are mainly on hillsides and foot slopes. Included areas make up about 10 percent of the total acreage.

The Worock soil is deep and well drained. It formed in glacial till and colluvium. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is pale brown very stony loam about 6 inches thick. The subsurface layer is very pale brown very stony loam about 12 inches thick. The subsoil is light yellowish brown very gravelly clay loam about 34 inches thick. The substratum to a depth of 60 inches or more is very pale brown very gravelly clay loam.

Permeability of the Worock soil is moderately slow. Available water capacity is about 5 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

The Mikesell soil is deep and well drained. It formed in material derived from shale. Typically, the surface is covered with a mat of partially decomposed forest litter about 2 inches thick. The surface layer is light brownish gray clay loam about 8 inches thick. The upper 23 inches of the subsoil is brown shaly clay, and the lower part to a depth of 60 inches or more is light gray shaly clay.

Permeability of the Mikesell soil is slow. Available water capacity is about 8 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The soils in this unit are used as woodland and for understory grazing.

Rangeland management. The potential native forest understory on the Worock soil is mainly grouse

whortleberry, blue huckleberry, white spirea, and silvery lupine. The understory produces about 400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 200 pounds in years of below-normal precipitation.

The potential native forest understory on the Mikesell soil is mainly heartleaf arnica, western meadowrue, pinegrass, and grouse whortleberry. The understory produces about 800 pounds of air-dry vegetation per acre in years of above-normal precipitation and 400 pounds in years of below-normal precipitation.

Steepness of slope limits access by livestock on this unit.

Forest management. The Worock soil is suited to lodgepole pine, Douglas fir, Engelmann spruce, and subalpine fir. The site index is 64 for lodgepole pine, 57 for Douglas fir, and 77 for Engelmann spruce. The potential annual production (CMAI) per acre is about 60 cubic feet or 180 board feet (Scribner rule) for lodgepole pine, 80 cubic feet or 290 board feet for Douglas fir, and 70 cubic feet or 320 board feet for Engelmann spruce. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

The Mikesell soil is suited to lodgepole pine, Engelmann spruce, Douglas fir, and subalpine fir. The site index is 67 for lodgepole pine, 84 for Engelmann spruce, and 52 for Douglas fir. The potential annual production (CMAI) per acre is about 65 cubic feet or 190 board feet (Scribner rule) for lodgepole pine, 80 cubic feet or 360 board feet for Engelmann spruce, and 75 cubic feet or 250 board feet for Douglas fir. Potential production is estimated for an even-aged, fully stocked stand of trees. Yield estimates for subalpine fir were not made.

Timber management is limited mainly by steepness of slope and the content of clay in the Mikesell soil. Steepness of slope and the clayey texture of the Mikesell soil limit the kinds of equipment that can be used, the ease of operation, and the time of use. The Mikesell soil has low strength when wet, which results in poor trafficability and the possibility of soil compaction when heavy equipment is used to yard logs. Operating equipment only when the soil is dry or frozen can overcome this limitation. Water erosion is a hazard on the soils in this unit if they are disturbed. Maintaining plant cover in disturbed areas and maintaining strips of vegetation along streams minimize soil erosion and stream sedimentation. The understory vegetation competes with tree seedlings. Reduction of competing vegetation encourages adequate natural regeneration and the survival of planted seedlings. Windthrow can be a hazard on this unit during periods of soil wetness and high winds.

Roads. If the Worock soil is used for roads, it is limited mainly by slope and stoniness. If the Mikesell soil is used for roads, it is limited mainly by slope, low strength, and the potential for shrinking and swelling and frost action. Seeding cuts and fills, surfacing roads, and using drainage structures reduce soil erosion and production of sediment from roads. The low strength of the Mikesell soil when wet, the potential of the Mikesell soil for shrinking and swelling and frost action, and steepness of slope adversely affect road performance and soil stability. Stoniness of the Worock soil makes excavation, leveling, and road construction difficult.

Homesite development. The soils in this unit are poorly suited to homesite development because of the steepness of slope.

This map unit is in capability subclass VIIs, nonirrigated. The Worock soil is in woodland suitability group 5R, and the Mikesell soil is in woodland suitability group 6R.

160—Yetull loamy sand, cool, 2 to 8 percent slopes. This deep, somewhat excessively drained soil is on fans, foot slopes, and terraces in the northern and western parts of the survey area. It formed in alluvium derived dominantly from gneiss, schist, and granite. Elevation is 4,500 to 6,500 feet. The average annual precipitation is about 12 inches, the average annual air temperature is about 40 degrees F, and the average frost-free period is about 100 days.

Included in this unit are small areas of soils that have a very gravelly or stony surface layer. These soils are at the apex of fans and at the base of foot slopes. Included areas make up about 10 percent of the total acreage.

Typically, the surface layer of this Yetull soil is grayish brown loamy sand about 8 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray loamy coarse sand.

Permeability is rapid. Available water capacity is about 4 inches. Effective rooting depth is 60 inches or more. Where this soil is under native vegetation, the average annual wetting depth is about 36 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high. This soil is droughty because of the sandy texture.

This unit is used mainly as rangeland and for irrigated hay and pasture. It is also used for nonirrigated grass for pasture. It is poorly suited to cultivated crops because of the hazard of soil blowing and droughtiness. The main irrigated crops are alfalfa and grass.

Cropland management. If this unit is used for irrigated hay and pasture, it is limited mainly by low available water capacity. Growing grasses and legumes for hay and pasture reduces soil blowing, runoff, and water erosion. Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Because the soil is droughty, light and frequent applications of irrigation water are needed.

Rangeland management. The potential native plant community is mainly prairie sandreed, bluebunch wheatgrass, Indian ricegrass, needleandthread, threadleaf sedge, green sagewort, and yucca. If the range is excessively grazed, the proportion of bluebunch wheatgrass, prairie sandreed, and Indian ricegrass decreases and the proportion of needleandthread, threadleaf sedge, sand dropseed, prairie junegrass, green sagewort, and yucca increases. If overgrazing continues, plants such as broom snakeweed, rubber rabbitbrush, and annual bromes may invade. The potential native plant community produces about 2,400 pounds of air-dry vegetation per acre in years of above-normal precipitation and 1,040 pounds in years of below-normal precipitation.

Rangeland seeding of native plants or adapted introduced grasses and legumes is a suitable practice if the range vegetation is in poor condition. The surface layer is susceptible to water erosion and soil blowing if it is disturbed or the rangeland is overgrazed.

Windbreak management. This unit is poorly suited to windbreaks. It has very limited available water capacity, which restricts the growth of trees and shrubs. Suitable trees for planting are Russian olive, Siberian crabapple, Siberian elm, and Rocky Mountain juniper. Suitable shrubs are Siberian peashrub, silver buffaloberry, western sandcherry, and skunkbush sumac. If irrigated, this unit is also suited to lilac shrubs and golden willow, cottonwood, and blue spruce trees. The hazard of soil blowing can be reduced by cultivating only between rows of windbreaks.

Homesite development. This unit is suited to homesite development. Because the substratum is rapidly permeable, effluent from septic tank absorption fields may contaminate ground water. Cutbanks are not stable and are subject to slumping.

This map unit is in capability subclasses VIe, nonirrigated, and IVe, irrigated. It is in Sands range site, 10- to 14-inch precipitation zone.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the nation's short- and long-range needs for food and fiber. The supply of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the use of our nation's prime farmland with wisdom and foresight.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when it is treated and managed using acceptable farming methods. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland may now be in cultivated crops, rangeland, woodland, or other uses. It does not include urban and built-up areas or water areas. To qualify as prime farmland, it must either be used for producing food or fiber or be available for these uses.

In this survey area, prime farmland has an adequate and dependable supply of irrigation water. It also has favorable temperature and growing season and acceptable acidity and alkalinity. It has few or no rock fragments in the surface layer; however, some soils have many rock fragments in the substratum. It is permeable to air and water, is not excessively erodible, and is not frequently flooded. It is not saturated with water for long periods, or the water table is maintained at a depth sufficient to allow crops to be grown. Slopes range from 0 to 4 percent. For more detailed information on the criteria for prime farmland, consult the local office of the Soil Conservation Service.

About 38,000 acres of this survey area consists of soils that would meet all the requirements for prime farmland if they were irrigated; however, not all this acreage is presently being irrigated.

Most of the land that would qualify as prime farmland is in general soil map units 1, 2, and 4. The main areas are on the nearly level terraces near Cameron, on the east bench south of Twin Bridges, and on the bottom lands along the major rivers.

Most of the prime farmland on the river bottoms is presently being irrigated and is used mainly for hay and pasture. About 50 percent of the other land is presently being irrigated and is used mainly for hay and small grain. The rest of the prime farmland is not presently being irrigated, but it would be classified as prime farmland if it were irrigated from a dependable water supply of adequate quality.

Following is a list of the soils in this survey area that are prime farmland if irrigated.

10	Attewan loam, cool, 0 to 2 percent slopes
27	Brocko silt loam, cool, 0 to 2 percent slopes
33	Crago gravelly loam, cool, 0 to 8 percent slopes
58	Havre loam, cool, 0 to 2 percent slopes
61	Kalsted sandy loam, 0 to 2 percent slopes
83	Musselshell gravelly loam, cool, 0 to 2 percent slopes
131	Thess sandy loam, cool, 2 to 4 percent slopes
133	Thess-Amesha loams, cool, 0 to 2 percent slopes

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and for hay and pasture is suggested in this section. The system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops and hay and pasture plants commonly grown are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Nonirrigated Cropland

About 18,000 acres in this survey area is used for the production of nonirrigated crops. Most of this acreage is in the Harrison-Norris area, in the northeastern part of the survey area. Winter wheat and barley are the most commonly grown nonirrigated crops. Some spring wheat, oats, and tame pasture crops are also grown.

Summer fallow is used where irrigated crops are grown because many of the soils suitable for crops do not receive enough precipitation during the growing season to ensure the production of a profitable grain crop. When small grain is planted, moisture stored in the soil during the fallow period is available to supplement the precipitation received during the normal growing season. Chemical or mechanical weed control, or both, during the fallow period is necessary to prevent loss of soil moisture.

A flexible cropping system is also well suited to many parts of the survey area. Flexible cropping is a system of growing crops based on the amount of precipitation stored in the soil in fall and winter and the average rainfall received during the growing season. When the amount of moisture stored in the root zone and the normal average potential rainfall during the growing season are enough to produce a crop, one can be grown. The average annual precipitation for most of the areas of nonirrigated cropland is about 14 inches. About 65 percent, or 9 inches, of this comes during the growing season, which is April through August. To

ensure a successful crop, practices that conserve moisture and control weeds are essential when a flexible cropping system is used.

The main concerns in managing nonirrigated cropland in the survey area are conserving moisture, protecting the cropland from soil blowing and water erosion, and controlling weeds. The silty soils used for crops in the Harrison-Norris area are highly susceptible to soil blowing and water erosion.

Use of minimum tillage, no-till cropping, stubble mulching, stripcropping, cover crops, tall grass barriers, field windbreaks, or a combination of these practices reduces the hazard of soil blowing and conserves soil moisture.

Minimum tillage is a system that limits the number of tillage operations to only those necessary to grow a crop. Conventional tillage practices commonly compact the soil, destroy soil tilth, and pulverize the surface, leaving it subject to blowing. Minimum tillage limits the number of trips across the field, thus reducing the risk of soil compaction and maintaining good soil tilth. Because the soil surface is left rough and cloddy except in the immediate seedbed area, it is less susceptible to soil blowing and is more open to air and water infiltration. Minimum tillage also leaves more crop residue on the surface, which further protects the soil from blowing and improves infiltration of water. When this practice is used, chemical weed control is also practiced.

No-till cropping is a system in which the soil is left undisturbed prior to planting and fertilization. Planting is completed in a narrow seedbed about 1 inch to 3 inches wide. Weed control is accomplished primarily with herbicides.

Stubble mulching leaves as much crop residue as feasible on or near the soil surface during tillage. The total soil surface is disturbed by tillage prior to planting. Weed control is accomplished with a combination of herbicides and cultivation.

Tall grass barriers are planted in rows 30 to 50 feet apart across fields. Both tall grass barriers and grain stubble protect the soil from blowing. They also trap snow, which increases the amount of moisture stored in the soil.

Field windbreaks are best suited to areas in and around large open fields. They generally consist of one row of shrubs or trees. Rows are spaced across the field at approximately right angle to the prevailing wind. Well designed and maintained field windbreaks reduce soil blowing, conserve moisture, control snow drifting, protect crops and livestock, provide food and shelter for wildlife, and enhance the natural beauty of the area.

Water erosion can be controlled by stripcropping, growing cover crops, constructing grassed waterways, and maintaining crop residue on the surface.

When strips of crops and fallow are arranged straight up and down the slope, runoff water moves rapidly downslope through the fallow strips and can be highly erosive. Strips of crops arranged across the slope or on the contour intercept runoff as it moves downslope and reduce the risk of water erosion.

Areas of cropland that receive concentrated flow of runoff water can be protected by grassed waterways. These areas are planted to perennial grasses to stabilize the soil. Well planned and constructed grassed waterways can prevent gullying and help to control removal of excess runoff from cropland.

Crop residue on the surface reduces the risk of water erosion by absorbing the impact of raindrops and preventing sealing of the surface. This keeps the surface open for better water infiltration, thus reducing the runoff potential.

There is a high potential for use of tame pasture grasses to improve forage production and control erosion of overgrazed rangeland in the survey area. Converting overgrazed areas to tame pasture improves the quality and quantity of forage, protects the soil, and reduces water loss. Tame pastures should be seeded to grasses suited to the kind of soil to achieve a balanced grazing program for all seasons. In this survey area, early-season species generally are needed to reduce the grazing pressure on native range.

Irrigated Cropland

About 130,000 acres in the survey area is used for irrigated crops and pasture. The major areas of irrigated cropland are along the bottom lands of the Ruby, Beaverhead, Big Hole, and Jefferson Rivers, on the uplands immediately adjacent to and along these rivers, and on the East Bench Irrigation Project, south of Twin Bridges. Other areas that have soils and climate suitable for irrigated crops are on the gently sloping fans and terraces in the major valleys.

Hay and pasture are the most commonly grown irrigated crops in the survey area. Areas of irrigated hay and pasture make up about 95 percent of the total irrigated acreage. Grass, alfalfa, and alfalfa-grass mixtures are the most common hay crops. Orchardgrass, the main grass species, is mixed with alfalfa for use as hay. Orchardgrass, timothy, Kentucky bluegrass, and smooth brome are the main species used as irrigated pasture and hay.

Spring wheat, barley, and oats are the grain crops

grown under irrigation. These crops are harvested for grain by some operators and are cut for hay by others.

Irrigation water for most of the survey area is delivered through a system of canals and ditches. Water for the Ruby Valley is stored in the Ruby River Reservoir. The Vigilante and West Bench Canals, the two major canals serving the Ruby Valley, divert water stored in the Ruby River Reservoir. The East Bench Irrigation Project is served by the East Bench Canal, which diverts water from the Beaverhead River. Water for this irrigation system is stored upriver in the Hap-Hawkins Reservoir, south of Dillon. Besides these three major canal systems, other areas are served by water diverted at various points along the Beaverhead, Big Hole, Ruby, Jefferson, and Madison Rivers. Upland areas are also irrigated by water diverted from some of the major mountain streams. Most of the land served by these irrigation systems is flood irrigated; however, it is rapidly being converted to more efficient sprinkler irrigation systems.

Management of irrigated pasture and hay generally includes growing small grain in rotation with alfalfa or grass. As an area of pasture or hay becomes older, the proportion of weedy plants and less productive grasses increases. Hay or pasture can be left for 5 or 6 years; to help control weedy plants, small grain should then be grown for 1 or 2 years before the new hay or pasture crop is seeded. Growing small grain in rotation allows the old forage plant residue time to fully deteriorate in the soil, which increases the fertility of the soil and improves soil tilth.

Irrigated pasture and hay production can be enhanced by the use of fertilizer. Phosphorus is applied to increase alfalfa production, and nitrogen is added to increase grass production. When a small grain crop follows a hay or pasture crop, the soil generally is quite fertile from the decomposition of the old alfalfa and grass; however, supplemental fertilization may be needed to increase production. A fertilization program should be based on soil tests.

The main management concerns on irrigated cropland in the survey area are overirrigation and the inefficiency of flood systems. In upland areas excess irrigation water may travel downslope through the rapidly permeable subsoil of some soils. Large areas of wet soils commonly are downslope from heavily irrigated areas, mainly along the Ruby and Beaverhead Rivers. Seepage from irrigation canals also results in areas of wet soils adjacent to some canals in the survey area. In nearly level areas that are flood irrigated, irrigation water commonly is ponded in low-lying spots while higher lying spots do not receive enough water.

The slope, kind of soil, and crop to be grown should be considered when planning an irrigation system. Slope mainly determines what type of system is suitable. The soil type and crop to be grown determine how much water to apply, the rate at which it can be applied, and when to apply it.

Contour ditch irrigation is suitable on slopes of as much as 15 percent. When the ditches are placed on the contour and spaced according to slope and kind of soil, irrigation efficiency of 40 to 55 percent is possible.

Border irrigation is controlled surface flooding. It is suited to nonsod-forming crops where slopes are as much as 2 percent and to sod-forming crops where slopes are as much as 4 percent. If fields are properly leveled and graded, irrigation efficiency of 45 to 60 percent is possible.

Corrugations are small furrows along the slope. They are suited to slopes of as much as 8 percent. Irrigation efficiency of 50 to 60 percent is possible.

Sprinkler irrigation is considered to be the best method of applying water on most of the soils in the survey area. It permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Sprinkler irrigation is well suited to slopes of as much as 15 percent. Most of the sprinkler irrigated soils in the survey area are on the gently sloping fans and nearly level benches throughout the area.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each

crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(10)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils generally are grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Rangeland

By Eugene Handl, range conservationist, Soil Conservation Service.

About 80 percent of the land in Madison County is rangeland or grazeable woodland. More than 85 percent of the farm income is derived from livestock, mainly cattle. Cow-calf is the major type of livestock operation. The average size of ranches is 3,100 acres.

Some ranches cultivate only enough land to produce sufficient hay for the unit while others combine hay and grain production for sale with raising of livestock. Only a few ranches have commercial feedlots. Most of the livestock grazing is on native rangeland. Insufficient spring pasture is common in the survey area. Many ranchers do not have places to graze their livestock between the time they stop feeding and the time the

native ranges have sufficient growth to safely provide grazing. Much of the summer grazing is on land leased from the Forest Service and Bureau of Land Management, often at considerable distances from the ranch headquarters.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

In the following paragraphs some of the terms used in each map unit description in the section "Detailed Soil Map Units" are discussed.

The potential native plant community is described using the common names of the major grasses, forbs, and shrubs. Some of the species likely to be present where the potential vegetation has been altered by past use are also given. Production is given, and important unique management considerations are discussed.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Rangeland management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The native vegetation in many parts of the survey area has been changed by prolonged heavy grazing. Desirable grasses and forbs such as bluebunch wheatgrass, green needlegrass, and Columbia needlegrass have been replaced by Idaho fescue, prairie junegrass, and big sagebrush, thus reducing forage production.

The objective in rangeland management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Woodland Management and Productivity

Harold E. Hunter, forester, Soil Conservation Service, assisted in the preparation of this section.

About 190,000 acres of the survey area is forested. Of this, 63,000 acres is under the management of the federal government. Another 60,000 acres is owned and managed by the Burlington Northern Railroad. The rest is in private or state ownership. Most of the forest land is grazed.

The major part of the forest land in the survey area is in the Madison Range. There is also forest land around the edge of the Gravelly Range, the Tobacco Root Mountains, and the Highland Mountains and in the Ruby Range.

Forest types covering the largest acreages within the survey area are lodgepole pine and Douglas fir. Lodgepole pine covers a large acreage at the higher elevations and commonly is associated with the Worock, MacFarlane, Loberg, and Shadow soils. The major stands of Douglas fir occur at lower elevations on Shadow, warm; Whitecow; and Comad soils or on Whitore soils that occur across a wide elevational range. Whitore soils have developed from parent

material that is high in content of limestone such as that in the Ruby Range. Engelmann spruce does not form an extensive type within the survey area, but it is an important component in stands of trees on some soils such as those of the Mikesell series. Subalpine fir also is not an extensive type, at present, within the survey area; in undisturbed areas of the Shadow soils, however, subalpine fir forms the dominant forest type. Stands of whitebark pine occur only near timberline on the Shadow soils. Limber pine is a minor component of these whitebark pine stands. Scattered stands of Rocky Mountain juniper and limber pine are present in the foothills. These stands commonly are intermingled with grassland at low elevations; associated soils are those of the Crago, Shurley, Pensore, Poin, and Blackhall series. Rocky Mountain juniper and limber pine are also associated with Rock outcrop in these areas. Stands of quaking aspen are scattered throughout the foothills and mountains; associated soils are those of the Hapgood, Adel, and Earcree series. Stands of plains cottonwood grow along the major rivers and streams; associated soils are those of the Rivra and Ryell series.

Lodgepole pine, Douglas fir, and Engelmann spruce are the main commercial species in the survey area; they are the most desirable species for use in manufacturing wood products. Subalpine fir, limber pine, and whitebark pine are not highly desired. Little use is being made of the aspen and cottonwood except locally as a source of firewood.

The subalpine fir type presently is not extensive; however, subalpine fir is the most common tree that reproduces beneath stands of lodgepole pine. In time, without disturbance by fire, insects, logging, or other environmental factors, subalpine fir will replace the lodgepole pine to form the climax forest overstory. Subalpine fir may form the climax forest overstory on MacFarlane, Mikesell, Loberg, Worock, and Shadow soils. Engelmann spruce most commonly forms the climax forest overstory on Mikesell soils at lower elevations. The Douglas fir climax forest overstory will most commonly form on the Comad and Whitore soils.

The average annual growth of lodgepole pine trees, at the culmination of mean annual increment (CMAI), considering an average stand density, is 21,260,000 board feet for the survey area, or about 180 board feet per acre. Similar values expressed in cubic feet would be 7,200,000 cubic feet total and 60 cubic feet per acre. The average annual growth of Douglas fir trees at the culmination of the mean annual increment (CMAI), considering an average stand density, is 29,955,000 board feet total for the survey area, or about 195 board feet per acre. Similar values expressed in cubic feet would be 9,180,000 cubic feet total and 60 cubic feet per acre.

Many of the softwood stands are 140 to 200 years old and are mature or overmature. Conditions can be improved and productivity increased by harvesting mature and diseased trees. Forage yields of the understory plants can also be increased by harvesting, which will benefit livestock and wildlife.

There is no formal organization to provide fire protection on forest land outside the national forest boundary.

Insect and disease control on private lands is essentially the responsibility of the private landowners. Technical assistance to the private landowner concerned with insect and disease control is available from the Forestry Division of the Montana Department of Natural Resources and Conservation and the Headwaters Resource Conservation and Development Project.

There are severe mountain pine beetle and spruce budworm epidemics within the survey area. The mountain pine beetle attacks stands of lodgepole pine and whitebark pine. Spruce budworm is affecting the growth and quality of Douglas fir. Dwarf mistletoe is prevalent throughout stands of lodgepole pine and Douglas fir. In some areas, porcupines are seriously affecting the quality and growth of timber stands. The differences among the soils in the survey area do not appear to have a marked effect on the incidence of disease or insect infestations. In those areas where the soils determine the tree species that will be present, the presence or absence of a particular insect or disease may be indirectly controlled by the soil. For example, the Whitore soils support nearly pure stands of Douglas fir, which increases the chances of a spruce budworm epidemic and virtually excludes mountain pine beetles. On the Shadow soils the situation is reversed. The Shadow soils support stands of lodgepole pine, whitebark pine, and subalpine fir but very little Douglas fir. As a result there are heavy infestations of mountain pine beetle and only rare cases of spruce budworm attacks.

At present there are only a few small private sawmills within the area that produce rough-cut lumber. Most of the timber harvested within the survey area is used for sawlogs and pulpwood. The timber is hauled to Dillon for processing. There are a few post and pole plants in operation in the Ruby Valley. Timber harvesting within the area is increasing as more insect damaged stands are salvaged.

Intensive forest management is becoming a reality in the survey area as a result of conservation programs,

an expanding market, and educational work by public and private foresters.

To aid those who manage forest land in the survey area, soil interpretations relating to woodland use and management have been developed. Items considered for interpretation are site index, erosion hazard, equipment limitations, plant competition, seedling mortality, windthrow hazard, species suitability and yield, and kinds of understory plants.

Woodland management information for each forested soil is contained in table 6 and in the section "Detailed Map Unit Descriptions." Definitions, ratings, and assumptions are explained in the following paragraphs.

In table 6, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Equipment limitations in this survey area were related to logging operations. Of prime consideration were difficulties encountered in yarding logs and the influence of logging activities on soil properties.

Primary soil features considered in making this rating were slope, soil texture, soil depth, seasonal soil wetness, and stoniness.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

As interpreted for this survey area, the above criteria apply to planting stock 1 or 2 years old and the evaluation period begins at the time of planting. For natural regeneration, the evaluation period was considered to begin a year after germination.

Ratings of *windthrow hazard* consider the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Soils on north-facing slopes that remain moist into spring and those that have a high basal area that limits root development were considered to be moderately prone to windthrow even though the soil materials provided a good anchoring medium for tree roots. On drier sites, clayey soils without rock fragments were considered in this category. Soils that have a high water table within 20 inches of the surface long enough to inhibit root development were considered to be severely susceptible to windthrow.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

In making ratings for plant competition, the limitation was considered slight if adequate regeneration usually occurs on a soil within 5 years. The plant competition rating was reduced one class for soils that have clayey subsoil layers within 20 inches of the surface when compared with soils that have similar environmental settings and support similar vegetation but do not have clayey subsoil layers.

Trees to plant are those that are suited to the soils and to commercial wood production. The tree species are listed in order of decreasing productivity on the site when productivity is expressed as average annual yield in board feet per acre.

Common trees are the trees that are most commonly encountered on the different soils. For the more common trees, particularly those of commercial value, site index values have been determined.

Contained in each map unit description is additional information relating to forest management. Included information is site index, potential yield estimates, a discussion of the major soil features affecting use and management of the soils for forestry, and the woodland suitability group.

Site index is a value that ranks soil productivity for a specified tree species. Site index is the average height, in feet, that dominant and codominant trees of a given species in the stand attain in a specified number of

years. The specified number of years (base age) varies according to the author of the publication used to determine the site index of a species. The specified age is 100 years for lodgepole pine, whitebark pine, and Engelmann spruce and is 50 years for Douglas fir. Site index values are not directly comparable from one species to another. The site index applies to fully stocked, even-aged, unmanaged stands. Site index values were computed according to R.R. Alexander for lodgepole pine, whitebark pine *(1)*, and Engelmann spruce *(2)* and J.E. Brickell for Douglas fir *(5)*.

Site index can be used in conjunction with yield tables to develop estimates of potential growth of adapted tree species on different soils. Yield estimates in the map unit descriptions are expressed as average annual board feet (Scribner rule) per acre and total average annual cubic feet per acre. The mean annual increment (MAI) is computed at the culmination of mean annual increment (CMAI). Culmination of mean annual increment is the point in time during the life of a stand of trees at which the average annual yield is greatest.

Potential yield estimates presented in the map units were determined from average annual yield at CMAI versus site index curves that were developed through adjustment of data presented in yield tables published from several different sources. "Tables of Yields and Mean Annual Increments of Fully Stocked Stands in Major Forest Types in Region One" *(11)* was the primary reference used for estimating yield of Douglas fir. Board-foot volumes for Douglas fir and Engelmann spruce in the reference are based upon the Scribner log rule for all trees larger than 5 inches in diameter at breast height (DBH at 4.5 feet). Total cubic-foot volume estimates are for trees 0.6 inch or more in diameter at breast height and including the stump and tip of the tree but not the bark.

"Yield Tables for Managed Stands of Lodgepole Pine in Colorado and Wyoming" by C.A. Meyers *(7)* was used for estimating the yield of lodgepole pine. Board-foot volumes for lodgepole pine in the reference are based upon Scribner's log rule and includes all trees larger than 10 inches diameter at breast height to an 8-inch top diameter inside the bark. Total cubic foot volumes are based upon measurements of all trees taller than 4.5 feet from groundline to tip, exclusive of bark.

Yield tables used for Engelmann spruce were computer generated for SCS by Carlton B. Edminster, Rocky Mountain Forest and Range Experiment Station, and involve an initial basal area of 120 square feet per acre and a 20-year thinning interval. Board-foot estimates are based on trees 8 inches in diameter at breast height or larger to a 6-inch top.

The soil limitations to use and management discussed in the map unit descriptions relate primarily to management concerns identified in table 6; however, other concerns may also be identified, such as potential for soil compaction. Only the major soil factors affecting use and management are discussed. Commonly they are the factors that result in severe ratings or are responsible for two or more moderate ratings.

Woodland suitability group is given for each soil in the section "Detailed Soil Map Units." Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the woodland suitability ordination symbol is the class, which is a number that indicates the potential productivity of the soils for the most productive tree species. The number represents the total average annual yield of wood in cubic meters per hectare when computed at the culmination of mean annual increment. To convert the value to total cubic feet per acre, multiply the class number by 14.3. The second part of the symbol, the subclass, is a letter indicating the major kind of soil limitation. In this survey area X, C, R, and A are used. The letter X indicates stoniness or rockiness; C, clay in the upper part of the soil; and R, steep slopes. The letter A indicates that limitations or restrictions are insignificant. If a soil has more than one limitation the priority is as follows: X, C, and R.

Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

The value of forest understory for use as forage can be increased by thinning the forest overstory. On forested sites that are overstocked with respect to timber production, both timber production and forage can be increased by thinning.

In each detailed map unit description in the section

"Detailed Soil Map Units" is given the plants commonly present in the understory, a suitability rating describing the amount of forage available for livestock, and an estimate of the herbage produced in years of above normal and below normal precipitation. Because understory plant composition and herbage vary with the density of the tree canopy and with the degree of disturbance, these conditions are specified. The information presented for the soils in a map unit description reflects the potential native plant community beneath a forest overstory canopy representing the optimum stocking for timber production. Typically, the canopy density representing optimum stocking would vary from 40 percent on soils in dry environments to 60 percent on soils in moist environments.

Total production of understory vegetation includes that of herbaceous plants and the leaves, twigs, and fruit of woody plants to a height of 4.5 feet.

The adjective rating expressing the suitability of the forest understory plant community for grazing by livestock is a relative rating based upon the potential animal unit months (AUM) of grazing available per acre under the conditions specified above. *Limited* is defined as less than 0.15, and *moderate* as 0.15 to 0.35 AUM per acre per year.

Windbreaks

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angle to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Windbreaks are discussed in the map unit descriptions in the section "Detailed Soil Map Units." Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

The natural resources of the survey area provide much potential for recreational development. The Madison Range, Gravelly Range, and Tobacco Root Mountains are especially popular for hunting, fishing, hiking, and camping. Snowmobiling and cross-country skiing are popular winter activities in these areas. The Big Sky Ski Area in the Madison Range is the most developed recreational area. Although this ski area is in Madison County, the only roads to the ski area that are maintained are through Gallatin County.

Fishing is one of the major recreational activities in the area. The Madison, Ruby, Jefferson, Beaverhead, and Big Hole Rivers provide good trout fishing. These rivers are heavily used by fishermen during summer. Access to the rivers is provided from numerous sites administered by the Montana Department of Fish, Wildlife, and Parks and from recreational sites maintained by the Bureau of Land Management. Camping is available at many of these sites.

Ennis Lake and the Ruby River Reservoir are other popular fishing areas. They are also used for water skiing and picnicking in summer and for ice fishing in winter.

The Beartrap Primitive Area is along the Madison River, north of Ennis Lake. This area provides wilderness camping as well as fishing and daytime hiking. White-water rafting is also available along certain stretches of the Madison River that are within the primitive area.

Recreational developments such as picnic areas, playgrounds, campgrounds, trails, and access areas are subject to intensive use. Because of the concentration of a large number of people in recreational areas, the soils are subject to stresses that become a concern for soil management. Soil properties should be considered when planning new recreational facilities or when improving existing facilities.

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties generally are favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey; for example, interpretations for dwellings without basements and for local roads and streets in table 8 and interpretations for septic tank absorption fields in table 9.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Ronald F. Batchelor, biologist, Soil Conservation Service, assisted in the preparation of this section.

In this section wildlife species and their habitat are discussed and related to the various general soil map units shown on the general soil map at the back of this survey. Soils and other physical and climatic characteristics of the map units are described in the section "General Soil Map Units."

Wildlife is a product of the land. The abundance of a species is directly related to the extent of its habitat. Species of wildlife are closely associated with the plant communities that comprise their habitat, and the soil largely determines the composition of the plant communities. Productive, well managed soils generally support or have potential to support vigorous wildlife populations, while infertile, poorly managed soils commonly support sparse populations. Together, plants and animals constitute natural communities that are controlled by many environmental influences, of which soil is but a part.

Coniferous forests, glaciated peaks, rolling grasslands, riparian woodlands, irrigated and nonirrigated croplands, streams and rivers, ponds, marshes, and reservoirs provide a variety of habitats for the wildlife in the survey area.

Moose live throughout much of the survey area. Both migratory and resident populations are in the area. High-elevation spruce and fir forests are used extensively in summer and fall. Migratory moose move along drainageways to lower elevations as late-winter snows accumulate on high slopes and return as snow cover is removed in spring. Moose are primarily browsers, and they use a variety of willows and other deciduous species. Forbs are an important part of their diet in spring and summer.

General soil map units 10, 11, and 13 provide most of the habitat for moose within the survey area; however, there are resident moose in parts of map unit 1, and in winter there are migratory moose.

Rocky Mountain elk live in the foothills and mountains throughout the survey area. Elk spend the summer and fall at relatively high elevations, where moist, lush forest types are interspersed with grassy mountain meadows. Movement to lower elevations begins early to late in fall, depending upon snowfall. Winter range commonly consists of grassy, windblown

ridges or south-, east-, or west-facing foot slopes.

General soil map units 10, 11, 12, and 13 provide most of the summer elk habitat within the survey area. Units 3, 6, 7, and 9 provide most of the winter elk habitat, especially where these areas border forested areas.

Both white-tailed deer and mule deer live throughout the survey area. White-tailed deer generally inhabit the lowlands and stream bottoms. They are especially common along the lower Madison, Big Hole, Jefferson, and Ruby Rivers and their tributary streams. Map unit 1 provides most of the habitat for white-tailed deer.

Mule deer are present in a variety of habitats throughout the area. They are most common at the mid to high elevations and along the foothills of the major mountain ranges. Map units 10, 11, and 13 provide habitat primarily for mule deer in summer. Units 1, 3, 6, 7, and 9 provide year-round habitat for mule deer.

Map units 4 and 5 provide most of the habitat for pronghorn antelope. Pronghorn antelope inhabit open grassland or sagebrush and grass prairie that is frequently adjacent to agricultural land. They are most abundant in Madison Valley but are common throughout the lower elevations of the area.

Map units 10 and 12 provide most of the habitat for bear within the survey area. Black bear are present in a variety of forest habitats varying from mountain meadows to spruce and fir forests. Grizzly bear are known to be present in parts of the Madison range.

Bighorn sheep and mountain goat are present in many of the high rugged mountain ranges of Madison County but are outside the survey area.

Some mountain lions are present throughout the mountain ranges in Madison County.

Irrigated and nonirrigated farming made possible the successful introduction of the ring-necked pheasant and gray partridge, particularly on the bottom lands of the survey area, along the lower Ruby, Jefferson, and Madison Rivers.

General soil map unit 1 provides the major part of the bottom land habitat for pheasants, in the form of irrigated cropland, brushy ditchbanks, and fence rows. The irrigated parts of map units 2 and 4 provide good habitat for pheasants in the form of grain fields and brushy drainageways.

Gray, or Hungarian, partridge also are associated with cropland and grassland areas of the survey area. Sharp-tailed grouse are present throughout much of the prairie uplands of the Madison River valley near Ennis, where grain fields, brushy cover, and an abundance of fruit-bearing shrubs, including chokecherry, rose, snowberry, and sumac, provide excellent habitat.

Map units 2 and 3 support plant communities that have good potential as habitat for sharp-tailed grouse and gray partridge. On these map units, grain fields, brushy draws, and an intermix of shrubs and grass provide suitable habitat for these prairie species.

Map units 3, 6, and 9 provide good habitat for sage grouse in the form of brushy drainageways and sagebrush-covered rangeland. Sage grouse are common in the western part of the area, in the vicinity of Sage and Sweetwater Creeks, and on the sage-covered uplands between Ennis and Virginia City.

Two species of forest-dwelling grouse—blue and ruffed grouse—are common in the coniferous forests and riparian woodlands of the mountains. The brushy thickets, stream bottoms, mixed forests, and grazeable woodlands of map units 10, 11, and 13 provide habitat for blue and ruffed grouse. Blue grouse are closely associated with the distribution of subalpine fir and Douglas fir. The extent and quality of forest grouse habitat is largely determined by forest management practices, grazing practices, and fire.

Numerous marshes, ponds, rivers, and reservoirs provide habitat for waterfowl during spring and fall migrations. Ducks, geese, swans, and a variety of shore birds and marsh birds use the bodies of water for resting, nesting, and rearing of young.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building Site Development, Sanitary Facilities, Construction Materials, and Water Management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Laboratory data are not included as a part of this

survey. Analyses of some soils were conducted by the Montana Highway Department, Materials Division, in cooperation with the Federal Highway Administration, Department of Transportation. These data were considered in determining the estimated engineering properties given in tables 12 and 13.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, and natural soil structure aggregation. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps and soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit for small commercial buildings is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect

the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 9 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage because of rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground

water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 10, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the taxonomic unit descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a *probable* source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight,

large stones. All other soils are rated as an *improbable* source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 11 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even more than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of

ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 12 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 to 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added; for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials *(3)* and the Unified soil classification system *(4)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification; for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are

indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 13 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each taxonomic unit under "Soil Series and Their Morphology."

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to absorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil

for crop production, the stability of the soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the amount of stable aggregates 0.84 millimeters in size. These are represented idealistically by USDA textural classes. Soils containing rock fragments can occur in any group.

1. Sand, fine sand, and very fine sand. These soils generally are not suitable for crops. They are extremely erodible, and vegetation is difficult to establish on them.

2. Loamy sand, loamy fine sand, and loamy very fine sand. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loam, coarse sandy loam, fine sandy loam, and very fine sandy loam. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clay, silty clay, clay loam, and silty clay loam that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loam and sandy clay that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loam. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loam that is less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 13, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 14 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are

assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sand or gravelly sand. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay that has high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered to be flooding. Standing water in swamps and marshes or in closed depressional areas is considered to be ponding.

Table 14 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable period of flooding are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable, *rare* that it is unlikely but is possible under unusual weather conditions (chance of flooding in any year is 0 to 5 percent), *occasional* that it occurs infrequently under normal weather conditions (chance of flooding in any year is 5 to 50 percent), and *frequent* that it occurs often under normal weather conditions (chance of flooding in any year is more than 50 percent).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that flooding is most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic flood. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table K are the depth to the seasonal high water table; the kind of water table—that is, *perched, artesian*, or *apparent*; and the months of the year that the water table usually is highest. A water table that is seasonally high for less than 1 month is not indicated in the table.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower water table by a dry zone.

The two numbers in the column "High water table" indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth

of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

A cemented pan is a cemented or indurated subsurface layer at a depth of 5 feet or less. Such a pan causes difficulty in excavation. Pans are classified as thin or thick. A *thin* pan is one that is less than 3 inches thick if continuously indurated or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A *thick* pan is one that is more than 3 inches thick if continuously indurated or more than 18 inches thick if it is discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 14 shows the expected initial subsidence, which usually is a result of drainage, and annual subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(12)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 15 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Boroll *(Bor*, meaning cool, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiborolls *(Arg*, meaning an argillic horizon is present, plus *boroll*, the suborder of the Mollisols that has a frigid temperature regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup that typifies the great group. An example is Aridic Argiborolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, Aridic Argiborolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (9)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (12)*. Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Adel Series

The Adel series consists of deep, well drained soils on fans and terraces and in swales of uplands and in mountainous areas. These soils formed in alluvial, colluvial, and eolian material. Slope is 0 to 25 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 15 to 24 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is less than 90 days.

These soils are fine-loamy, mixed Pachic Cryoborolls.

Typical pedon of Adel loam, 4 to 15 percent slopes, in an area of rangeland, 2,300 feet west and 1,500 feet south of the northeastern corner of sec. 34, T. 12 S., R. 2 E.

A11—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent pebbles; many fine and very fine roots; neutral; abrupt wavy boundary.

A12—10 to 23 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent pebbles; common fine and very fine roots; neutral; clear wavy boundary.

A13—23 to 37 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent pebbles; common fine and very fine roots; neutral; clear wavy boundary.

B1—37 to 46 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 5 percent pebbles; common fine and very fine roots; neutral; gradual wavy boundary.

B2—46 to 60 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; neutral.

Coarse fragment content is 0 to 35 percent in the upper 40 inches. The A horizon is loam or gravelly loam, and the B horizon is loam, clay loam, or gravelly loam. The reaction is neutral or mildly alkaline in the B horizon.

Amesha Series

The Amesha series consists of deep, well drained soils on fans and terraces and in dissected drainageways of uplands. These soils formed in calcareous alluvium. Slope is 0 to 25 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are coarse-loamy, mixed Borollic Calciorthids.

Typical pedon of Amesha loam, cool, 2 to 8 percent slopes, in an area of hayland, 500 feet north and 700 feet east of the southwest corner of sec. 6, T. 2 S., R. 4 W.

Ap—0 to 7 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—7 to 16 inches; white (10YR 8/2) loam, pale brown (10YR 6/3) moist; weak medium prismatic structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine roots; disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—16 to 22 inches; light gray (10YR 7/2) loam, pale brown (10YR 6/3) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common very fine and fine roots; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

C3—22 to 60 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; strongly effervescent; moderately alkaline.

Coarse fragment content is 0 to 5 percent in the upper 40 inches and 0 to 35 percent below this depth. In some pedons the C3 horizon is mainly sandy loam that has thin strata of gravelly sandy loam and loamy sand. The Ap horizon is mildly alkaline or moderately alkaline.

A bedrock substratum phase of this series is recognized in this survey area. This phase has weakly consolidated loamy sedimentary beds at a depth of 40 to 60 inches. Between a depth of 30 inches and the

loamy sedimentary beds, the texture is mainly loam that has thin strata of very fine sandy loam, silt loam, and sandy loam.

Amsterdam Series

The Amsterdam series consists of deep, well drained soils on rolling hills and terraces. These soils formed in silty lacustrine and eolian material. Slope is 2 to 15 percent. Elevation is 4,800 to 5,200 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-silty, mixed Typic Haploborolls.

Typical pedon of Amsterdam silty clay loam, 2 to 8 percent slopes, cultivated, 2,100 feet south and 1,600 feet east of the northwest corner of sec. 28, T. 2 S. , R. 3 E.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, friable, slightly sticky and plastic; many very fine and fine roots; neutral; abrupt smooth boundary.

B2t—5 to 11 inches; dark brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few very fine and fine roots; few thin patchy clay films on faces of peds; neutral; clear wavy boundary.

C1ca—11 to 18 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; violently effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—18 to 34 inches; white (10YR 8/2) silt loam, very pale brown (10YR 7/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; violently effervescent; moderately alkaline; clear wavy boundary.

C3—34 to 60 inches; white (10YR 8/2) very fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; 10 percent soft siltstone pebbles; strongly effervescent; moderately alkaline.

The Ap horizon is 5 to 9 inches thick, and the combined thickness of the A and B horizons is 11 to 20 inches. The B horizon is silt loam or silty clay loam. The C horizon is silty clay loam, silt loam, or very fine sandy loam; in places it is stratified below a depth of 30 inches.

Armitage Series

The Armitage series consists of deep, well drained soils on terraces and fans. These soils formed in alluvium of mixed mineralogy. Slope is 0 to 4 percent. Elevation is 5,000 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Borollic Natrargids.

Typical pedon of an Armitage cobbly loam in an area of Armitage-Thess, cool, complex, 0 to 4 percent slopes, in an area of rangeland, 2,000 feet north and 1,600 feet west of the southeast corner of sec. 17, T. 9 S. , R. 1 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) cobbly loam, dark brown (10YR 3/3) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine and fine pores; 15 percent cobbles and 5 percent pebbles; mildly alkaline; abrupt wavy boundary.

A2—4 to 5 inches; light gray (10YR 7/2) cobbly loam, grayish brown (10YR 5/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine and fine pores; 15 percent cobbles and 5 percent pebbles; mildly alkaline; abrupt wavy boundary.

B21t—5 to 7 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; strong medium columnar structure; very hard, very firm, very sticky and very plastic; few very fine roots within peds and few very fine and fine roots on faces of peds; few very fine and fine pores; many moderately thick dark yellowish brown (10YR 4/4) clay films on faces of peds and lining pores; moderately alkaline; abrupt smooth boundary.

B22t—7 to 13 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak fine angular blocky; very hard, firm, very sticky and very plastic; few very fine and fine roots within peds and few very fine and fine roots on faces of peds; few very fine and fine pores; common moderately thick dark

brown (10YR 3/3) clay films on faces of peds and lining pores; moderately alkaline; abrupt wavy boundary.

C1ca—13 to 18 inches; light gray (2.5Y 7/2) silt loam, light brownish gray (2.5Y 6/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, slightly sticky and slightly plastic; few very fine roots; few very fine and fine pores; common fine distinct soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—18 to 36 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; slightly hard, firm, slightly sticky and slightly plastic; few very fine roots; few very fine and fine pores; common fine distinct soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

IIC3—36 to 60 inches; pale brown (10YR 6/3) extremely gravelly sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; 55 percent pebbles and 10 percent cobbles; slightly effervescent; moderately alkaline.

Depth to very gravelly or extremely gravelly sand ranges from 20 to 40 inches. The A1 horizon is 15 to 35 percent rock fragments, mainly cobbles, and under native grass it is 2 to 4 inches thick. The upper part of the B horizon is clay and averages 40 to 50 percent clay, and the lower part is clay loam or loam and averages 24 to 32 percent clay. Depth to the Cca horizon ranges from 10 to 20 inches. The IIC horizon is 45 to 55 percent pebbles and 5 to 15 percent cobbles. The sodium absorption ratio is 15 to 25 in the B and Cca horizons. The electrical conductivity in these horizons is 4 to 8 millimhos per centimeter.

Attewan Series

The Attewan series consists of deep, well drained soils on fans and terraces. These soils formed in mixed alluvium. Slope is 0 to 8 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls.

Typical pedon of Attewan cobbly loam, 2 to 8 percent slopes, in an area of rangeland, 1,200 feet north and 1,500 feet west of the southeast corner of sec. 17, T. 9 S., R. 1 E.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine roots; many fine irregular pores; 15 percent pebbles and 15 percent cobbles; neutral; clear wavy boundary.

B2t—4 to 11 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; common fine roots; common fine vesicular and tubular pores; 10 percent pebbles; common faint dark brown (10YR 3/3, moist) clay films on faces of peds; mildly alkaline; abrupt wavy boundary.

C1ca—11 to 20 inches; white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine vesicular and tubular pores; 5 percent pebbles; disseminated lime and thick lime coatings on undersides of pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

IIC2—20 to 60 inches; grayish brown (2.5Y 5/2) very gravelly loamy sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose; few fine roots; many fine interstitial pores; 40 percent pebbles and 10 percent cobbles; strongly effervescent; moderately alkaline.

The A horizon is 0 to 35 percent rock fragments. The B horizon is clay loam or sandy clay loam. It is 5 to 25 percent pebbles and cobbles. The C1ca horizon is loam or silt loam. It is 0 to 30 percent pebbles. Depth to the IIC horizon is 20 to 40 inches. The horizon is 35 to 75 percent rock fragments. The fine earth fraction is loamy sand or sand.

Bearmouth Series

The Bearmouth series consists of deep, well drained soils on terraces and fans. These soils formed in gravelly and stony alluvium. Slope is 0 to 8 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 34 to 38 degrees F, and the frost-free period is 60 to 90 days.

These soils are sandy-skeletal, mixed Typic Cryoborolls.

Typical pedon of Bearmouth gravelly loam, 2 to 8 percent slopes, in an area of rangeland, 1,300 feet east

and 400 feet north of the southwest corner of sec. 29, T. 11 S., R. 2 E.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly loam, black (10YR 2/1) moist; weak medium platy structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 15 percent pebbles; neutral; abrupt wavy boundary.

A12—3 to 7 inches; dark brown (10YR 4/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; 20 percent pebbles; neutral; clear wavy boundary.

B2—7 to 15 inches; brown (10YR 5/3) very gravelly loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and very fine roots; 40 percent pebbles; neutral; abrupt wavy boundary.

IIC—15 to 60 inches; brown (10YR 4/3) extremely gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky and nonplastic; 65 percent pebbles; few thin lime coatings on undersides of rock fragments; mildly alkaline.

Sand and gravel are at a depth of 10 to 20 inches. The A horizon is 3 to 10 inches thick and is extremely stony loam or gravelly loam. It is 15 to 35 percent rock fragments. The fine earth fraction of the B horizon is loam or sandy loam and is 35 to 60 percent rock fragments, mainly pebbles or stones. It is neutral or mildly alkaline. Depth to the IIC horizon ranges from 10 to 20 inches. The horizon is extremely gravelly loamy sand or sand. It is neutral or mildly alkaline.

Beaverell Series

The Beaverell series consists of deep, well drained soils on outwash terraces and fans. These soils formed in alluvium. Slope is 0 to 6 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are loamy-skeletal, mixed Aridic Argiborolls.

Typical pedon of Beaverell cobbly loam, cool, 0 to 6 percent slopes, in an area of rangeland, 2,500 feet south and 300 feet east of the northwest corner of sec. 28, T. 9 S., R. 1 E.

A1—0 to 4 inches; brown (10YR 5/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine and fine pores; 10 percent cobbles and 15 percent pebbles; mildly alkaline; clear wavy boundary.

B2t—4 to 11 inches; brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; common very fine pores; common thin clay films on ped faces and in pores and common moderately thick clay films coating fragments; 5 percent cobbles and 35 percent pebbles; mildly alkaline; clear wavy boundary.

B3—11 to 17 inches; yellowish brown (10YR 5/4) very gravelly sandy loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine pores; 10 percent cobbles and 35 percent pebbles; mildly alkaline; abrupt wavy boundary.

IICca—17 to 60 inches; very pale brown (10YR 7/3) extremely gravelly loamy sand, pale brown (10YR 6/3) moist; single grain; loose; few very fine and fine roots; 10 percent cobbles and 60 percent pebbles; violently effervescent; moderately thick lime coatings on undersides of fragments; moderately alkaline.

The A horizon is 15 to 35 percent rock fragments, the B horizon is 35 to 60 percent rock fragments, and the C horizon is 60 to 80 percent rock fragments. The B2t horizon is mainly clay loam or sandy clay loam, and the B3 horizon has a fine earth fraction that is mainly sandy loam or sandy clay loam. The A1 and B2 horizons are neutral or mildly alkaline. The B3 and IIC horizons are mildly alkaline or moderately alkaline. Depth to the IIC horizon is 10 to 20 inches.

Blackhall Series

The Blackhall series consists of shallow, well drained soils on uplands. These soils formed in material derived from siltstone and sandstone. Slope is 15 to 45 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents.

Typical pedon of a Blackhall sandy loam in an area of Blackhall-Rock outcrop, 15 to 45 percent slopes, in an area of rangeland, 1,000 feet south and 100 feet west of the northeast corner of sec. 26, T. 1 N., R. 4 W.

A1—0 to 2 inches; light brownish gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine interstitial pores and few very fine and fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—2 to 16 inches; grayish brown (2.5Y 5/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; common very fine interstitial pores and few very fine and fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

Cr—16 inches; weakly consolidated loamy sedimentary beds consisting of interbedded sandstone and siltstone.

Depth to weakly consolidated loamy sedimentary beds is 10 to 20 inches. The profile is 0 to 10 percent rock fragments, mainly sandstone and chert. The A horizon is 2 to 4 inches thick. Clay content is 5 to 15 percent.

Blaine Series

The Blaine series consists of moderately deep, well drained soils on upland hills, ridges, and benches. These soils formed in material derived from igneous bedrock. Slope is 2 to 25 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Argic Cryoborolls.

Typical pedon of Blaine stony loam, 2 to 15 percent slopes, in an area of rangeland, 2,500 feet north and 600 feet west of the southeast corner of sec. 6, T. 6 S., R. 2 W.

A1—0 to 6 inches; brown (10YR 4/3) stony loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 5 percent rounded stones, 5 percent rounded cobbles, and 10 percent pebbles; neutral; abrupt wavy boundary.

B2t—6 to 10 inches; dark yellowish brown (10YR 4/4) very stony clay loam, dark brown (10YR 3/3) moist; strong fine subangular blocky structure; hard, firm, sticky and plastic; common moderately thick clay films on faces of peds; 15 percent rounded stones and 20 percent angular pebbles; neutral; clear wavy boundary.

IIB3—10 to 19 inches; yellowish brown (10YR 5/6) very stony loam, dark yellowish brown (10YR 3/6) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 20 percent angular stones and 35 percent angular pebbles; mildly alkaline; abrupt wavy boundary.

IIC1ca—19 to 25 inches; very pale brown (10YR 8/4) extremely stony loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; 40 percent angular stones and 30 percent angular pebbles; disseminated lime and lime coatings on rock fragments; violently effervescent; mildly alkaline; gradual wavy boundary.

R—25 inches; fractured igneous bedrock.

Reaction is neutral in the upper 10 inches of the profile and is mildly alkaline or moderately alkaline below this depth. Depth to bedrock is 20 to 40 inches. Rock fragment content is 10 to 30 percent in the A1 horizon, 35 to 50 percent in the Bt horizon, and 35 to 80 percent in the IIB3 and IIC horizons. Texture of the fine earth fraction of the B horizon is loam or clay loam. Texture of the C1 horizon is loam or fine sandy loam.

Branham Series

The Branham series consists of moderately deep, well drained soils on hills. These soils formed in residuum and colluvium derived dominantly from granite and granitic gneiss. Slope is 2 to 45 percent. Elevation is 5,500 to 7,000 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are coarse-loamy, mixed Typic Cryoborolls.

Typical pedon of Branham coarse sandy loam, 2 to 8 percent slopes, in an area of rangeland, approximately 500 feet east and 300 feet south of the center of sec. 8, T. 2 S, R. 6 W.

A11—0 to 2 inches; grayish brown (10YR 5/2) coarse sandy loam, very dark brown (10YR 2/2) moist;

weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; 10 percent pebbles; medium acid; abrupt smooth boundary.

A12—2 to 4 inches; brown (10YR 5/3) coarse sandy loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine roots; 10 percent pebbles; medium acid; clear smooth boundary.

B2—4 to 22 inches; brown (10YR 5/3) gravelly coarse sandy loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine roots; few thin clay films bridging sand grains; 25 percent pebbles; neutral; clear smooth boundary.

C—22 to 30 inches; gravelly coarse sand that is very pale brown (10YR 7/3) and white (10YR 8/2) when dry or moist; single grain; loose, nonsticky and nonplastic; few very fine roots; 30 percent pebbles; mildly alkaline; clear smooth boundary.

R—30 inches; granite.

The content of rock fragments, mainly pebbles, ranges from 0 to 15 percent in the upper 4 inches of the profile and from 10 to 35 percent below this depth. The textural control section is 4 to 18 percent clay and averages more than 25 percent coarse sand and very coarse sand. The A horizon is medium acid to neutral, and the B and C horizons are neutral or mildly alkaline.

Bridger Series

The Bridger series consists of deep, well drained soils on terraces, glacial moraines, and foot slopes. These soils formed in alluvium and glacial till. Slope is 2 to 35 percent. Elevation is 5,500 to 8,000 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine, mixed Argic Cryoborolls.

Typical pedon of Bridger cobbly clay loam, 8 to 35 percent slopes, in an area of rangeland, 500 feet south and 400 feet west of the northeast corner of sec. 14, T. 10 S., R. 5 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) cobbly clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 10 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

B1t—4 to 7 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and very fine roots; common moderately thick dark grayish brown (10YR 4/2) clay films on faces of peds and coating some pores; 5 percent pebbles and 5 percent cobbles; neutral; abrupt wavy boundary.

B2t—7 to 17 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; moderate coarse prismatic structure parting to strong fine and medium angular blocky; very hard, very firm, very sticky and very plastic; many fine and very fine roots between peds; few fine and very fine roots within peds; many thick dark yellowish brown (10YR 4/4) clay films on faces of peds and coating pores; 5 percent pebbles; neutral; clear wavy boundary.

B3tca—17 to 21 inches; light yellowish brown (10YR 6/4) gravelly clay loam, yellowish brown (10YR 5/4) moist; weak fine prismatic structure parting to strong fine angular blocky; hard, firm, sticky and plastic; many fine and very fine roots between peds and few fine and very fine roots within peds; common moderately thick clay films on faces of peds and coating some pores; 30 percent pebbles; strongly effervescent; mildly alkaline; clear wavy boundary.

C1ca—21 to 29 inches; very pale brown (10YR 7/3) very gravelly sandy clay loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; 40 percent pebbles; violently effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—29 to 60 inches; very pale brown (10YR 7/3) very gravelly sandy clay loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine and very fine roots; 50 percent pebbles; violently effervescent; moderately alkaline.

The A horizon is clay loam or cobbly clay loam. It is 5 to 30 percent rock fragments. It is neutral or mildly alkaline. The B horizon is 5 to 30 percent rock fragments. The B1 and B2t horizons are neutral or mildly alkaline, and the B3tca horizon is mildly alkaline or moderately alkaline.

The B2t horizon is clay loam or clay. The C horizon is 35 to 50 percent rock fragments. Depth to the Cca horizon is 17 to 34 inches. The fine earth fraction of the Cca horizon is clay loam, loam, or sandy clay loam.

Calcium carbonate equivalent is 5 to 15 percent. The horizon is mildly alkaline or moderately alkaline.

The Bridger soils in the northeastern part of the survey area are taxadjunct to the Bridger series because they either do not have a Cca horizon or it is at a depth of more than 34 inches. The use and management of these soils, however, is not significantly different.

Brocko Series

The Brocko series consists of deep, well drained soils on fans and terraces. These soils formed in alluvial and eolian material. Slope is 0 to 25 percent. Elevation is 4,300 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are coarse-silty, mixed Borollic Calciorthids.

Typical pedon of Brocko silt loam, cool, 2 to 12 percent slopes, in an area of rangeland, 600 feet north and 2,000 feet east of the southwest corner of sec. 6, T. 1 S., R. 2 W.

A1—0 to 8 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; moderate to strong medium granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots; few very fine and fine tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—8 to 17 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine tubular pores; common soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2ca—17 to 39 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; weak to moderate fine and medium platy structure; soft, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; common soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C3—39 to 48 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C4—48 to 60 inches; light gray (10YR 7/2) very fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine tubular pores; 5 percent rock fragments; violently effervescent; moderately alkaline.

The A horizon is 2 to 8 inches thick. In some areas that are not cultivated there is a silty clay loam B horizon as much as 3 inches thick. Content of rock fragments, mainly pebbles, is 0 to 5 percent below a depth of 40 inches. The calcium carbonate equivalent in the Cca horizon is 15 to 20 percent. Texture of the C horizon is silt loam or very fine sandy loam.

Brocko Variant

The Brocko Variant consists of deep, well drained soils on foot slopes and terraces. These soils formed in tertiary lake sediment. Slope is 2 to 15 percent. Elevation is 4,500 to 5,200 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-silty, mixed (calcareous), frigid Typic Ustorthents.

Typical pedon of Brocko Variant silt loam, 2 to 12 percent slopes, in an area of cropland, 1,200 feet south and 500 feet east of the northwest corner of sec. 28, T. 2 S., R. 3 E.

Ap—0 to 5 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine platy structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; disseminated lime; 10 percent fine gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—5 to 10 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; massive; hard, friable, sticky and plastic; few fine and very fine roots; disseminated lime; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2ca—10 to 23 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, sticky and plastic; few fine and very fine roots; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

C3ca—23 to 60 inches; white (10YR 8/2) silt loam, very pale brown (10YR 7/3) moist; massive; soft, very

friable, slightly sticky and slightly plastic; disseminated lime; strongly effervescent; moderately alkaline.

The Cca horizon is silty clay loam or silt loam and averages 20 to 30 percent clay. The calcium carbonate equivalent in the Cca horizon is 15 to 20 percent. Coarse fragment content throughout the profile is 0 to 10 percent; fragments are mainly semihard, lime-cemented siltstone.

Bullrey Series

The Bullrey series consists of deep, well drained soils on upland benches. These soils formed in residuum derived from welded tuff and have a thin mantle of eolian material. Slope is 2 to 12 percent. Elevation is 6,400 to 7,400 feet. The average annual precipitation is 20 to 24 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine-loamy, mixed Pachic Cryoborolls.

Typical pedon of Bullrey loam, bedrock substratum, 2 to 12 percent slopes, in an area of rangeland, 500 feet south and 900 feet east of the northwest corner of sec. 12, T. 12 S., R. 1 E.

A11—0 to 10 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; 10 percent angular pebbles; slightly acid; diffuse smooth boundary.

A12—10 to 21 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; moderate coarse subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; 10 percent angular pebbles; slightly acid; clear wavy boundary.

B2—21 to 39 inches; light yellowish brown (10YR 6/4) gravelly loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; 30 percent angular pebbles; slightly acid; clear wavy boundary.

C1—39 to 48 inches; pale brown (10YR 6/3) very gravelly fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; 45 percent angular pebbles; slightly acid; diffuse wavy boundary.

C2r—48 to 60 inches; light yellowish brown (10YR 6/4) semiconsolidated welded tuff that crushes to loamy fine sand.

Depth to semiconsolidated welded tuff is 40 to 60 inches. Reaction is medium acid or slightly acid throughout the profile. The A horizon is 20 to 30 inches thick. It is 0 to 10 percent rock fragments, mainly angular pebbles. The B horizon has 15 to 35 percent rock fragments. The C1 horizon is 35 to 50 percent rock fragments.

Burnette Series

The Burnette series consists of deep, well drained soils on fans, on foot slopes, and in valleys. These soils formed in alluvium derived from interbedded shale and sandstone. Slope is 4 to 15 percent. Elevation is 5,600 to 6,200 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine, montmorillonitic Argic Pachic Cryoborolls.

Typical pedon of a Burnette clay loam in an area of Gaylord-Burnette complex, 4 to 15 percent slopes, in an area of rangeland, 1,500 feet north and 1,000 feet east of the southwest corner of sec. 16, T. 4 S., R. 3 E.

A1—0 to 13 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate medium and fine granular structure; slightly hard, firm, sticky and plastic; many very fine and fine roots and common medium roots; 5 percent fine angular pebbles; neutral; clear wavy boundary.

B1t—13 to 17 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; strong medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots and common medium roots; common pressure faces; 5 percent fine angular pebbles; neutral; clear wavy boundary.

B2t—17 to 26 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; strong medium angular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots between peds and few very fine roots within peds; many moderately thick very dark grayish brown (10YR 3/2) pressure faces; 10 percent angular sandstone pebbles; neutral; clear irregular boundary.

C1ca—26 to 60 inches; light gray (10YR 7/2) gravelly clay, grayish brown (10YR 5/2) moist; massive; hard, firm, sticky and plastic; few very fine and fine roots; 20 percent angular sandstone pebbles; disseminated lime; violently effervescent; moderately alkaline.

In most areas a surface mantle of stones was removed when these soils were cultivated. The mollic epipedon is 16 to 26 inches thick. Gravel content is 5 to 15 percent in the A and B horizons and is 5 to 25 percent in the C horizon. The Bt horizon is 10 to 25 inches thick. It is clay or silty clay and averages 40 to 50 percent clay. In some pedons the C horizon is lime-free. Depth to the Cca horizon ranges from 20 to 40 inches. The calcium carbonate equivalent ranges from 5 to 15 percent in the Cca horizon.

Comad Series

The Comad series consists of deep, excessively drained soils on glacial moraines, fans, and mountains. These soils formed in alluvium, colluvium, and glacial till derived from granite, granitic gneiss, and schist. Slope is 8 to 45 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 50 to 90 days.

These soils are sandy-skeletal, mixed Typic Cryorthents.

Typical pedon of a Comad very stony loamy sand in an area of Comad-Earcree complex, 8 to 45 percent slopes, in an area of woodland, 300 feet north and 800 feet east of the southwest corner of sec. 6, T. 2 S., R. 6 W.

O1—2 inches to 0; fresh and partially decomposed forest litter; abrupt smooth boundary.

A1—0 to 3 inches; dark brown (10YR 4/3) very stony loamy sand, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots and few coarse roots; common very fine, fine, and medium pores; 10 percent stones, 10 percent cobbles, and 10 percent pebbles; neutral; abrupt smooth boundary.

A2—3 to 17 inches; pale brown (10YR 6/3) very stony loamy sand, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine and fine roots and few coarse roots; common very fine and fine pores; 10 percent stones, 10 percent cobbles, and 15 percent pebbles; neutral; gradual smooth boundary.

A&B—17 to 42 inches; A2 part—very pale brown (10YR 7/3) very stony loamy sand, pale brown (10YR 6/3) moist; weak medium angular blocky structure; slightly hard, very friable, nonsticky and nonplastic. B2t part—lamellae of light yellowish brown (10YR 6/4) sandy clay loam; hard, friable, slightly sticky and slightly plastic; lamellae are wavy and discontinuous, ¼ to ½ inch thick, and 10 to 15 inches apart; few very fine, fine, and coarse roots; many very fine, fine, and coarse pores; 15 percent stones, 15 percent cobbles, and 20 percent pebbles; neutral; gradual smooth boundary.

B2—42 to 66 inches; light yellowish brown (10YR 6/4) very stony loamy sand, dark yellowish brown (10YR 4/4) moist; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; 15 percent stones, 15 percent cobbles, and 20 percent pebbles; neutral.

The A1 and A2 horizons are 15 to 50 percent rock fragments ranging in size from pebbles to stones and including a few boulders. The A&B horizon is 40 to 60 percent rock fragments ranging in size from pebbles to stones. The A2 and A&B horizons are loamy sand or sand. They are slightly acid or neutral. The A&B horizon is less than 10 percent lamellae of sandy clay loam or sandy loam.

Crago Series

The Crago series consists of deep, well drained soils on fans, terraces, and hills. These soils formed in gravelly or cobbly alluvium derived mainly from limestone. Slope is 0 to 45 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are loamy-skeletal, carbonatic Borollic Calciorthids.

Typical pedon of Crago gravelly loam, cool, 0 to 8 percent slopes, in an area of rangeland, 1,320 feet south and 1,900 feet east of the northwest corner of sec. 30, T. 5 S., R. 1 E.

A1—0 to 4 inches; light brownish gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and nonplastic; many fine roots; many fine irregular and tubular pores; lime

coatings on lower surfaces of pebbles; 20 percent pebbles; slightly effervescent; moderately alkaline; clear wavy boundary.

C1ca—4 to 14 inches; light gray (10YR 7/2) gravelly loam, light brownish gray (10YR 6/2) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine roots; common fine vesicular and tubular pores; few fine soft masses of lime, disseminated lime, and lime coatings on lower surfaces of pebbles; 30 percent pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—14 to 32 inches; white (10YR 8/2) very gravelly sandy loam, light gray (10YR 7/2) moist; massive; soft, very friable, nonsticky and nonplastic; common fine roots; common fine interstitial pores; disseminated lime and lime coatings on sand grains and pebbles; partly cemented with lime and silica; 15 percent cobbles and 35 percent pebbles; violently effervescent; moderately alkaline; clear irregular boundary.

IIC3—32 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly loamy sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; many fine and medium interstitial pores; lime coatings on lower surfaces of pebbles and cobbles; 20 percent cobbles and 50 percent pebbles; slightly effervescent; moderately alkaline.

The A1 horizon is loam, gravelly loam, very gravelly loam, or very stony loam. The Cca horizon is gravelly loam, very gravelly loam, or very stony loam. Calcium carbonate equivalent is 40 to 70 percent. Depth to the IIC horizon is more than 30 inches. The IIC3 horizon is very gravelly sandy loam, very cobbly sandy loam, or extremely gravelly loamy sand and is 50 to 80 percent rock fragments.

Earcree Series

The Earcree series consists of deep, well drained soils on fans, foot slopes, and terraces. These soils formed in alluvial, colluvial, and eolian material derived from gneiss, schist, sandstone, and granite. Slope is 2 to 60 percent. Elevation is 5,000 to 7,500 feet. The average annual precipitation is 16 to 24 inches, the average annual air temperature is 38 to 40 degrees F, and the frost-free period is less than 60 to 75 days.

These soils are coarse-loamy, mixed Pachic Cryoborolls.

Typical pedon of an Earcree gravelly sandy loam in an area of Comad-Earcree complex, 8 to 45 percent slopes, in an area of rangeland, 1,200 feet north and 1,800 feet east of the southwest corner of sec. 5, T. 2 S., R. 6 W.

A11—0 to 7 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate medium and fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common coarse roots; 15 percent pebbles; neutral; clear wavy boundary.

A12—7 to 18 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark brown (10YR 2/2) moist; moderate coarse and medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common coarse roots; 15 percent pebbles; neutral; abrupt irregular boundary.

B2—18 to 21 inches; pale brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common coarse roots; 20 percent pebbles; neutral; abrupt irregular boundary.

C1—21 to 49 inches; light brownish gray (10YR 6/2) gravelly coarse sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and slightly plastic; common fine and very fine roots; 30 percent pebbles; neutral; clear wavy boundary.

C2—49 to 63 inches; pale brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; 45 percent pebbles; neutral.

Content of rock fragments, mainly angular pebbles, throughout the solum ranges from 5 to 35 percent. The A horizon is 16 to 40 inches thick. The B and C horizons are sandy loam or coarse sandy loam. Loamy coarse sand is below a depth of 40 inches in some places.

Garlet Series

The Garlet series consists of deep, well drained soils on moraines and mountainsides. These soils formed in colluvium and glacial till derived from andesite, quartzite, and sandstone. Slope is 15 to 70 percent. Elevation is 8,000 to 9,500 feet. The average annual precipitation is 35 to 50 inches, the average annual air

temperature is 34 to 38 degrees F, and the frost-free period is less than 90 days.

These soils are loamy-skeletal, mixed Typic Cryochrepts.

Typical pedon of a Garlet very channery sandy loam in an area of Garlet, cool-Rock outcrop complex, 45 to 70 percent slopes, in an area of woodland, 250 feet north and 2,100 feet east of the southwest corner of sec. 25, T. 6 S., R. 2 E.

O1—1 inch to 0; fresh and partially decomposed twigs and needles; clear wavy boundary.

A21—0 to 4 inches; pale brown (10YR 6/3) very channery sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many fine and very fine roots and common coarse and medium roots; 30 percent channery fragments and 10 percent flagstones; medium acid; clear wavy boundary.

A22—4 to 15 inches; pale brown (10YR 6/3) very channery sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many fine and very fine roots and common coarse and medium roots; 40 percent channery fragments and 10 percent flagstones; medium acid; clear wavy boundary.

B2—15 to 26 inches; light yellowish brown (10YR 6/4) very channery sandy loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; many fine and very fine roots, common medium roots, and few coarse roots; 40 percent channery fragments and 20 percent flagstones; medium acid; abrupt irregular boundary.

C1—26 to 36 inches; pale brown (10YR 6/3) very channery sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and nonplastic; common medium, fine, and very fine roots and few coarse roots; 40 percent channery fragments and 20 percent flagstones; slightly acid; gradual wavy boundary.

C2—36 to 60 inches; pale brown (10YR 6/3) very channery sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and nonplastic; common fine and very fine roots and few medium roots; 45 percent channery fragments and 15 percent flagstones; slightly acid.

Content of rock fragments in the control section ranges from 40 to 70 percent. The rock fragments are mainly channery fragments, but they include 10 to 25 percent flagstones. The texture is loam or sandy loam throughout the profile. Clay content ranges from 10 to 25 percent. Reaction is medium acid or slightly acid in the A and B horizons and is slightly acid or neutral in the C horizon. In some pedons there is a dark-colored A1 horizon.

Gaylord Series

The Gaylord series consists of deep, well drained soils on fans and foot slopes and in valleys. These soils formed in alluvium derived from interbedded shale and sandstone. Slope is 4 to 15 percent. Elevation is 5,600 to 6,200 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine, montmorillonitic Boralfic Cryoborolls.

Typical pedon of a Gaylord loam in an area of Gaylord-Burnette complex, 4 to 15 percent slopes, in an area of hayland, 800 feet south and 1,800 feet west of the northeast corner of sec. 12, T. 4 S., R. 2 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; neutral; abrupt smooth boundary.

A2—6 to 9 inches; light gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium platy structure parting to weak medium granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral; abrupt wavy boundary.

B2t—9 to 22 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; strong medium columnar structure parting to strong medium and fine angular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots between peds and few very fine roots within peds; many thick very dark grayish brown (10YR 3/2) clay films on faces of peds and lining pores; neutral; clear wavy boundary.

C1ca—22 to 33 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; massive; hard, firm, sticky and very plastic; few very fine and fine roots; many large masses of gypsum and many medium soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—33 to 60 inches; pale yellow (2.5Y 7/4) silty clay,

light yellowish brown (2.5Y 6/4) moist; massive; hard, firm, sticky and very plastic; common medium masses of gypsum and common medium soft masses of lime; strongly effervescent; moderately alkaline.

In most areas a surface mantle of stones was removed when these soils were cultivated. Depth to the Cca horizon ranges from 20 to 40 inches. Thickness of the A1 horizon is 6 to 12 inches. Thickness of the A2 horizon ranges from 2 to 5 inches. The B2t horizon is 12 to 30 inches thick. It is clay or silty clay and averages 45 to 55 percent clay. The gravel content is less than 5 percent to a depth of 40 inches or more. The calcium carbonate equivalent in the Cca horizon is 10 to 15 percent.

Hanson Series

The Hanson series consists of deep, well drained soils on fans, foot slopes, hillsides, and moraines. These soils formed in calcareous alluvium, colluvium, and glacial till derived from limestone. Slope is 2 to 45 percent. Elevation is 5,000 to 8,000 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, carbonatic Calcic Cryoborolls.

Typical pedon of Hanson channery loam, 8 to 45 percent slopes, in an area of rangeland, 1,500 feet south and 100 feet east of the northwest corner of sec. 24, T. 1 S., R. 3 W.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) channery loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; common fine roots; few to common fine interstitial pores and few fine tubular pores; 20 percent channery fragments; neutral; clear wavy boundary.

A12—2 to 11 inches; gray (10YR 5/1) channery loam, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; few to common fine roots; few fine tubular pores; 20 percent channery fragments; strongly effervescent; mildly alkaline; clear wavy boundary.

C1ca—11 to 19 inches; light gray (10YR 7/2) very gravelly loam, grayish brown (10YR 5/2) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few to common fine tubular pores; 50 percent angular pebbles; common soft masses of lime, lime crusts on pebbles, and disseminated lime throughout; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—19 to 60 inches; white (10YR 8/1) very gravelly loam, light brownish gray (10YR 6/2) moist; massive; hard, firm, slightly sticky and slightly plastic; few fine tubular pores; 60 percent angular pebbles; few soft masses of lime, lime crusts on pebbles, and disseminated lime throughout; violently effervescent; moderately alkaline.

The A horizon is 7 to 16 inches thick. It is 20 to 35 percent rock fragments. The C horizon is 35 to 60 percent rock fragments. The Cca horizon has a calcium carbonate equivalent of 40 to 60 percent in the fine earth fraction.

Hapgood Series

The Hapgood series consists of deep, well drained soils on foot slopes, fans, moraines, upland benches, and hillsides. These soils formed in colluvium, glacial till, and alluvium derived from igneous and metamorphic rock. Slope is 2 to 60 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 15 to 24 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Pachic Cryoborolls.

Typical pedon of a Hapgood gravelly loam in an area of Woodhall-Blaine-Hapgood complex, 4 to 25 percent slopes, in an area of rangeland, 2,500 feet west and 200 feet north of the southeast corner of sec. 20, T. 6 S., R. 2 W.

A1—0 to 18 inches; very dark grayish brown (10YR 3/2) gravelly loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; 15 percent angular pebbles; slightly acid; gradual smooth boundary.

C1—18 to 60 inches; grayish brown (10YR 5/2) very gravelly loam, very dark grayish brown (10YR 3/2) moist; weak coarse angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 10 percent angular cobbles and 35 percent angular pebbles; neutral.

The upper 18 inches of the profile is 5 to 60 percent

rock fragments, of which 5 to 25 percent is angular gravel, 0 to 30 percent is angular cobbles, and 0 to 10 percent is stones. The profile below a depth of 18 inches is 35 to 60 percent rock fragments, of which 25 to 45 percent is angular gravel, 10 to 20 percent is angular cobbles, and 0 to 5 percent is stones. The A horizon is 16 to 40 inches thick. Some pedons have a brown B horizon at a depth of 16 to 30 inches. The C horizon is loam or clay loam with thin strata of sandy loam.

Havre Series

The Havre series consists of deep, well drained soils on flood plains, low terraces, and fans. These soils formed in loamy stratified alluvium. Slope is 0 to 2 percent. Elevation is 4,200 to 6,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents.

Typical pedon of Havre loam, cool, 0 to 2 percent slopes, in an area of rangeland, 300 feet north and 1,300 feet west of the southeast corner of sec. 22, T. 1 S., R. 5 W.

A11—0 to 4 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; many fine pores; slightly effervescent; mildly alkaline; clear wavy boundary.

A12—4 to 9 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; common fine pores; slightly effervescent; mildly alkaline; abrupt wavy boundary.

C1—9 to 14 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C2—14 to 19 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; massive; soft, very friable, slightly sticky and plastic; common very fine and fine roots; slightly effervescent; moderately alkaline; gradual irregular boundary.

C3—19 to 36 inches; gray (10YR 6/1) loam, dark gray (10YR 4/1) moist; massive; soft, very friable, slightly sticky and plastic; few very fine roots; slightly effervescent; moderately alkaline; abrupt wavy boundary.

C4—36 to 60 inches; light gray (10YR 7/2) sandy loam with thin strata of loam and silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine roots; slightly effervescent; moderately alkaline.

The C horizon is loam, fine sandy loam, or sandy loam that has thin strata of loam, silt loam, and clay loam. Reaction is mildly alkaline or moderately alkaline.

Kalsted Series

The Kalsted series consists of deep, somewhat excessively drained soils on fans, terraces, and hills. These soils formed in stratified calcareous alluvium and eolian material. Slope is 0 to 35 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are coarse-loamy, mixed Borollic Calciorthids.

Typical pedon of Kalsted sandy loam, 2 to 8 percent slopes, in an area of hayland, 1,400 feet south and 1,700 feet west of the northeast corner of sec. 18, T. 5 S., R. 4 W.

Ap—0 to 7 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; strongly effervescent; mildly alkaline; abrupt smooth boundary.

AC—7 to 11 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots; many very fine pores; 5 percent pebbles; strongly effervescent; mildly alkaline; clear wavy boundary.

C1ca—11 to 30 inches; white (10YR 8/2) sandy loam, very pale brown (10YR 7/3) moist; weak coarse prismatic structure; hard, firm, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 5 percent pebbles; disseminated lime and lime coatings on undersides of pebbles; violently effervescent; moderately

alkaline; clear wavy boundary.

C2ca—30 to 54 inches; pale brown (10YR 6/3) gravelly sandy loam and few thin strata of loamy sand, yellowish brown (10YR 5/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine tubular pores; 20 percent pebbles; many fine and medium very pale brown (10YR 8/3) irregular soft lime masses; violently effervescent; moderately alkaline; clear wavy boundary.

C3—54 to 60 inches; pale brown (10YR 6/3) gravelly sandy loam and common thin strata of loamy sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine vesicular pores; 20 percent pebbles; strongly effervescent; moderately alkaline.

The Ap or A1 horizon is sandy loam, gravelly sandy loam, or loamy sand. Coarse fragment content ranges from 0 to 30 percent. Reaction is mildly alkaline or moderately alkaline. The C horizon commonly is stratified. The upper part is mainly sandy loam with thin lenses of loam, very fine sandy loam, and silt loam. The lower part is mainly sandy loam or gravelly sandy loam and has thin lenses of loamy sand and very gravelly sandy loam. The Cca horizon has 15 to 30 percent calcium carbonate equivalent. Content of rock fragments in the C1ca horizon ranges from 0 to 15 percent, and that of the C2 and C3 horizons is 5 to 35 percent. The C horizon is mildly alkaline or moderately alkaline.

Larry Variant

The Larry Variant consists of deep, poorly drained soils on stream terraces. These soils formed in alluvium. Slope is 0 to 2 percent. Elevation is 4,500 to 5,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-loamy, mixed, frigid Histic Haplaquolls.

Typical pedon of Larry Variant peat, 0 to 2 percent slopes, in an area of native grass hayland, 900 feet north and 2,100 feet west of the southeast corner of sec. 28, T. 4 S., R. 1 W.

Oi—0 to 5 inches; very dark brown (10YR 2/2, rubbed and pressed) fibric material; about 90 percent fiber, about 60 percent rubbed; massive; nonsticky and nonplastic; 90 percent herbaceous material; strongly effervescent; mildly alkaline; abrupt smooth boundary.

A1—5 to 12 inches; black (N 2/0) loam, dark gray (N 4/0) dry; moderate coarse granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium roots; neutral; clear smooth boundary.

C1g—12 to 29 inches; greenish gray (5GY 5/1) clay loam, gray (5Y 6/1) dry; few fine prominent dark yellowish brown (10YR 4/6) mottles; massive; hard, firm, sticky and very plastic; many very fine roots and common fine roots; neutral; clear wavy boundary.

IIC2g—29 to 37 inches; greenish gray (5GY 5/1) very gravelly sandy loam, gray (2.5Y 6/1) dry; many medium prominent yellowish brown (10YR 5/6) mottles; massive; soft, very friable, slightly sticky and slightly plastic; few very fine and fine roots; 40 percent pebbles; neutral; clear wavy boundary.

IIIAb—37 to 65 inches; very dark gray (10YR 3/1) very gravelly loamy sand, light gray and gray (10YR 6/1) dry; many fine prominent dark yellowish brown (10YR 4/6) mottles; massive; loose, very friable, nonsticky and slightly plastic; 50 percent pebbles; neutral.

The Oi horizon is 4 to 8 inches thick. The water table is at the surface to a depth of 18 inches during the growing season. Depth to the IIC horizon ranges from 20 to 40 inches. The A horizon is 7 to 15 inches thick. The C1g horizon is clay loam, loam, or sandy clay loam. Reaction is neutral or mildly alkaline throughout the profile.

Leavitt Series

The Leavitt series consists of deep, well drained soils on fans, foot slopes, and terraces. These soils formed in alluvium. Slope is 2 to 25 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine-loamy, mixed Argic Cryoborolls.

Typical pedon of Leavitt stony loam, 2 to 25 percent slopes, in an area of rangeland, 1,500 feet east and 1,000 feet south of the northwest corner of sec. 16, T. 9 S., R. 1 E.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very

friable, nonsticky and nonplastic; 15 percent pebbles and 10 percent stones and cobbles; neutral; abrupt irregular boundary.

B2t—4 to 13 inches; brown (10YR 4/3) stony clay loam, dark brown (10YR 3/3) moist; strong fine subangular blocky structure; hard, friable, sticky and plastic; common thin clay films on ped faces and in pores; 15 percent pebbles and 10 percent stones and cobbles; neutral; clear smooth boundary.

B3—13 to 21 inches; pale brown (10YR 6/3) gravelly clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure; hard, friable, sticky and slightly plastic; 20 percent pebbles and 5 percent cobbles; neutral; clear wavy boundary.

C1ca—21 to 38 inches; white (10YR 8/2) gravelly loam, light brownish gray (10YR 6/2) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; 20 percent pebbles and 5 percent cobbles; violently effervescent; mildly alkaline; gradual smooth boundary.

C2ca—38 to 60 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; 20 percent pebbles and 5 percent cobbles; mildly effervescent; moderately alkaline.

Rock fragment content is 5 to 25 percent in the A horizon, 15 to 25 percent in the B horizon, and 15 to 60 percent in the C horizon. The fine earth fraction of the B horizon is clay loam, sandy clay loam, or loam and that of the C horizon is loam or sandy loam. Reaction is mildly alkaline or moderately alkaline in the C horizon.

Libeg Series

The Libeg series consists of deep, well drained soils on glacial moraines, landslides, hills, and ridges. These soils formed in glacial till and colluvium. Slope is 4 to 45 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Argic Cryoborolls.

Typical pedon of a Libeg very stony loam in an area of Libeg-Adel complex, 4 to 25 percent slopes, in an area of rangeland, 300 feet south and 1,200 feet east of the northwest corner of sec. 8, T. 7 S., R. 2 W.

A1—0 to 7 inches; very dark gray (10YR 3/1) very stony loam, black (10YR 2/1) moist; moderate medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; 10 percent stones, 15 percent cobbles, and 15 percent pebbles; neutral; abrupt wavy boundary.

B21t—7 to 16 inches; grayish brown (10YR 5/2) very stony clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; many distinct very dark brown (10YR 2/2, moist) clay films on faces of peds; 10 percent stones, 15 percent cobbles, and 15 percent pebbles; neutral; clear wavy boundary.

B22t—16 to 33 inches; light yellowish brown (10YR 6/4) extremely stony clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; many distinct dark brown (10YR 3/3, moist) clay films on faces of peds; 30 percent stones, 30 percent cobbles, and 10 percent pebbles; neutral; clear wavy boundary.

B3t—33 to 60 inches; pale brown (10YR 6/3) extremely stony sandy clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; few dark brown (10YR 4/3, moist) clay films on faces of peds; 20 percent stones, 20 percent cobbles, and 35 percent pebbles; neutral.

Combined thickness of the A and B horizons is 40 to 60 inches or more. The A and B horizons are 40 to 80 percent rock fragments. These horizons are slightly acid or neutral.

Loberg Series

The Loberg series consists of deep, well drained soils on glacial moraines and mountainsides. These soils formed in colluvium and glacial till derived from mixed sources. Slope is 15 to 45 percent. Elevation is 6,500 to 8,000 feet. The average annual precipitation is 25 to 35 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is less than 60 days.

These soils are clayey-skeletal, mixed Typic Cryoboralfs.

Typical pedon of Loberg very stony loam, 15 to 45 percent slopes, in an area of coniferous woodland, 300 feet south and 400 feet east of the northwest corner of sec. 20, T. 7 S., R. 3 E.

O1—2 inches to 1 inch; fresh and partially decomposed

fir and pine needles and twigs; abrupt wavy boundary.

O2—1 inch to 0; decomposed forest litter; clear smooth boundary.

A1—0 to 7 inches; pinkish gray (7.5YR 6/2) very stony loam, dark brown (7.5YR 4/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and common coarse roots; many very fine and fine pores; 20 percent stones and cobbles and 20 percent pebbles; medium acid; gradual smooth boundary.

A2—7 to 11 inches; pinkish gray (7.5YR 7/2) very stony loam, brown (7.5YR 5/3) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; many very fine and fine pores; 20 percent stones and cobbles and 20 percent pebbles; slightly acid; clear wavy boundary.

B21t—11 to 18 inches; brown (7.5YR 5/3) very stony clay loam, dark brown (7.5YR 4/3) moist; moderate fine subangular blocky structure; very hard, firm, sticky and plastic; few very fine and fine roots; few fine pores; common thick reddish brown (5YR 5/3) clay films on faces of peds and lining pores; 25 percent stones and cobbles and 25 percent pebbles; slightly acid; abrupt smooth boundary.

B22t—18 to 42 inches; reddish brown (5YR 4/3) very stony clay, dark reddish brown (5YR 3/3) moist; moderate fine angular blocky structure; very hard, very firm, sticky and plastic; few very fine and fine roots; few fine pores; common thick dark reddish gray and reddish brown (5YR 4/2, 4/4) clay films on faces of peds and lining pores; 25 percent stones and cobbles and 25 percent pebbles; slightly acid; clear wavy boundary.

B3tca—42 to 60 inches; reddish gray (5YR 5/2) very stony clay, dark reddish gray (5YR 4/2) moist; moderate fine angular blocky structure; very hard, very firm, sticky and plastic; few very fine roots; common very fine and fine pores; few moderately thick dark reddish brown (5YR 3/4) clay films lining pores; 25 percent stones and cobbles and 25 percent pebbles; slightly effervescent; mildly alkaline.

Rock fragment content ranges from 35 to 60 percent throughout the profile; 15 to 30 percent of the fragments are more than 3 inches in diameter. The fine earth fraction of the upper part of the A horizon is loam; the lower part is loam or clay loam. In some pedons the A1 horizon is absent. The B2t horizon is at a depth of 10 to 22 inches, and it is more than 30 inches thick. The fine earth fraction of the B2 horizon is clay or clay loam. Some pedons do not have a B3ca horizon. Reaction is medium acid or slightly acid in the A and B2 horizons and is slightly acid to mildly alkaline in the B3 and C horizons.

MacFarlane Series

The MacFarlane series consists of deep, well drained soils on moraines, terraces, hillsides, and mountainsides. These soils formed in colluvium, glacial till, and glacial outwash derived from gneiss, schist, and granite. Slope is 4 to 45 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is less than 90 days.

These soils are loamy-skeletal, mixed Typic Cryoboralfs.

Typical pedon of MacFarlane stony sandy loam, 15 to 45 percent slopes, in an area of woodland, 2,500 feet south and 1,350 feet east of the northwest corner of sec. 12, T. 2 S., R. 3 W.

O1—2 inches to 0; partially decomposed forest litter.

A2—0 to 14 inches; pinkish gray (7.5YR 6/2) stony sandy loam, brown (7.5YR 4/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many fine and medium pores; 5 percent stones, 20 percent flagstones, and 5 percent channery fragments; medium acid; gradual smooth boundary.

B&A—14 to 22 inches; B part—yellowish brown (10YR 5/8) very flaggy sandy loam, yellowish brown (10YR 5/6) moist. A part—pinkish gray (7.5YR 6/2) very flaggy sandy loam, brown (7.5YR 4/2) moist. The B part has weak medium and fine subangular blocky structure, and the A part coats the blocks; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; common fine and medium pores; 5 percent stones, 30 percent flagstones, and 10 percent channery fragments; medium acid; gradual wavy boundary.

B21t—22 to 55 inches; yellowish brown (10YR 5/8) very flaggy sandy loam, yellowish brown (10YR 5/6) moist; weak medium and fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots;

common fine and medium pores; many moderately thick clay films on faces of peds and in pores; 2 percent stones, 35 percent flagstones, and 10 percent channery fragments; slightly acid; clear wavy boundary.

B22t—55 to 70 inches; yellowish brown (10YR 5/8) very flaggy sandy loam, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common medium and coarse roots; common fine and medium pores; many moderately thick clay films on faces of peds and in pores; 40 percent flagstones and 15 percent channery fragments; slightly acid; gradual wavy boundary.

IIC—70 to 80 inches; light yellowish brown (10YR 6/4) very cobbly loamy sand, yellowish brown (10YR 5/4) moist; loose, nonsticky and nonplastic; common medium and coarse roots; 45 percent cobbles and 10 percent pebbles; slightly acid.

Mica content ranges from 15 to 40 percent. Rock fragment content ranges from 35 to 60 percent. Reaction is medium acid to slightly acid throughout the profile.

Marias Series

The Marias series consists of deep, well drained soils on foot slopes. These soils formed in Tertiary lake sediment. Slope is 2 to 8 percent. Elevation is 4,500 to 5,000 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine, montmorillonitic, frigid Udorthentic Chromusterts.

Typical pedon of Marias silty clay loam, cool, 2 to 8 percent slopes, in an area of cropland, 1,100 feet south and 1,500 feet east of the northwest corner of sec. 25, T. 2 S., R. 2 E.

Ap—0 to 6 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist, strong medium and fine granular structure; hard, friable, slightly sticky and slightly plastic; common medium and fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

AC—6 to 15 inches; light gray (10YR 7/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse angular blocky structure; wedge-shaped natural aggregates in lower part; hard, friable, sticky and plastic; common medium and fine roots; slickensides on faces of aggregates; slightly effervescent; moderately alkaline; clear irregular boundary.

C1—15 to 26 inches; light gray (10YR 7/2) silty clay, grayish brown (10YR 5/2) moist; organic stains on faces of peds; moderate coarse angular blocky structure; wedge shaped natural aggregates with slickensides on the surface; hard, firm, sticky and plastic; few fine roots; common slickensides on prism faces; few fine nests of gypsum; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—26 to 32 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; massive; hard, firm, sticky and plastic; few fine roots; few fine threads of gypsum; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

C3cs—32 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (10YR 5/2) moist; massive; hard, friable, sticky and plastic; many fine seams of gypsum; disseminated lime; strongly effervescent; moderately alkaline.

Content of clay ranges from 35 to 60 percent throughout the profile.

Marias soils are in this survey area are taxadjunct to the series because they have a shorter growing season, receive slightly more precipitation, and have gypsum at a depth of 15 to 26 inches. These differences, however, do not significantly affect use and management.

Maxville Series

The Maxville series consists of deep, well drained soils on fans and terraces. These soils formed in eolian material and alluvium. Slope is 0 to 8 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Typic Cryoborolls.

Typical pedon of Maxville gravelly loam, 2 to 8 percent slopes, in an area of rangeland, 1,900 feet east and 200 feet south of the northwest corner of sec. 10, T. 12 S., R. 2 E.

A—0 to 11 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; soft, very friable, slightly sticky and

slightly plastic; many fine and very fine roots and common medium roots; 15 percent pebbles; neutral; clear wavy boundary.

B2—11 to 19 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium roots; 10 percent pebbles; neutral; abrupt wavy boundary.

C1ca—19 to 28 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; soft, very friable, sticky and slightly plastic; common medium, fine, and very fine roots; 10 percent pebbles; lime coatings on undersides of pebbles and disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—28 to 34 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, sticky and slightly plastic; common medium, fine, and very fine roots; 25 percent pebbles; lime coatings on pebbles and disseminated lime; violently effervescent; moderately alkaline; abrupt wavy boundary.

IIC3—34 to 60 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) moist; single grain; nonsticky and nonplastic; few medium and fine roots; 50 percent pebbles and 5 percent cobbles; strongly effervescent; moderately alkaline.

Depth to concentrated lime ranges from 11 to 23 inches. The A horizon is 6 to 14 inches thick. The fine earth fraction of the B and Cca horizons is silt loam, loam, or clay loam. The fine earth fraction of the IIC horizon is loamy sand or sand. Reaction is neutral above the C1ca horizon and is mildly alkaline or moderately alkaline in the Cca and IIC horizons. Content of rock fragments, mainly pebbles and a few cobbles, ranges from 5 to 35 percent above the IIC horizon and from 50 to 70 percent in the IIC horizon.

Mikesell Series

The Mikesell series consists of deep, well drained soils on mountainsides, foot slopes, and moraines. These soils formed in material derived from shale. Slope is 15 to 60 percent. Elevation is 6,500 to 8,000 feet. The average annual precipitation is 25 to 40 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is less than 90 days.

These soils are fine, montmorillonitic Typic Cryoboralfs.

Typical pedon of Mikesell clay loam, 45 to 60 percent slopes, in an area of woodland, 2,500 feet south and 50 feet east of the northwest corner of sec. 8, T. 8 S., R. 2 E.

O1—2 inches to 1 inch; undecomposed organic matter; abrupt smooth boundary.

O2—1 inch to 0; partially decomposed organic matter; abrupt smooth boundary.

A2—0 to 8 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many medium roots; many fine irregular pores; strongly acid; clear irregular boundary.

B21t—8 to 14 inches; very pale brown (10YR 7/3) clay, light olive brown (2.5Y 5/4) moist; strong medium subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many fine irregular pores; many faint dark grayish brown (2.5Y 4/2, moist) clay films on faces of peds; medium acid; clear smooth boundary.

B22t—14 to 31 inches; brown (10YR 5/3) shaly clay, grayish brown (10YR 5/2) moist; strong very fine and fine subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; few fine irregular pores; many distinct dark grayish brown (10YR 4/2, moist) clay films on faces of peds; 15 percent shale fragments; medium acid; clear smooth boundary.

B3—31 to 60 inches; light gray (5Y 7/2) shaly clay, light olive gray (5Y 6/2) moist; weak coarse prismatic structure; very hard, very firm, very sticky and very plastic; few fine roots; few fine irregular pores; common distinct very dark gray (2.5Y 3/0, moist) organic cutans on vertical faces; 15 percent shale fragments; neutral.

The profile is 0 to 20 percent rock fragments, mainly hard shale fragments and angular or flat lime concretions. The A2 horizon is strongly acid to slightly acid. The B horizon is clay or shaly clay and averages 40 to 60 percent clay. It is slightly acid or neutral below a depth of 31 inches. In some pedons a Cca horizon is present below a depth of 30 inches.

Musselshell Series

The Musselshell series consists of deep, well drained

soils on fans and terraces. These soils formed in alluvial and eolian material derived mainly from limestone. Slope is 0 to 25 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are coarse-loamy, carbonatic Borollic Calciorthids.

Typical pedon of Musselshell loam, cool, 2 to 8 percent slopes, in an area of rangeland, 700 feet north and 300 feet east of the southwest corner of sec. 36, T. 5 S., R. 6 W.

A11—0 to 4 inches; light brownish gray (10YR 6/2) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and plastic; many very fine, fine, and medium roots; common very fine and fine pores; 5 percent pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

A12—4 to 8 inches; pale brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many very fine, fine, and medium roots; common very fine and fine pores; 10 percent pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1ca—8 to 15 inches; white (10YR 8/2) loam, pale brown (10YR 6/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many very fine and fine roots; few fine pores; 10 percent pebbles; common fine soft masses of lime and lime coatings on pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—15 to 25 inches; very pale brown (10YR 7/3) gravelly loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common fine pores; 30 percent pebbles; common fine soft masses of lime, lime coatings on pebbles, and lime pendants on underside of pebbles; violently effervescent; moderately alkaline; clear smooth boundary.

C3ca—25 to 41 inches; white (10YR 8/2) very gravelly loam, pale brown (10YR 6/3) moist; moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 40 percent pebbles; common fine soft masses of lime, lime coatings on pebbles, and lime pendants on underside of pebbles; violently effervescent; moderately alkaline; gradual wavy boundary.

IIC4—41 to 60 inches; light gray (10YR 7/2) very gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; 60 percent pebbles; strongly effervescent; moderately alkaline.

The A horizon is loam or gravelly loam and is 5 to 25 percent pebbles. The C horizon is loam or gravelly loam in the upper part and very gravelly loam or very gravelly sandy loam in the lower part. There is a very gravelly loamy sand layer below a depth of about 40 inches in some pedons. The Cca horizon is 40 to 80 percent calcium carbonate. Reaction is moderately alkaline or strongly alkaline.

Neen Series

The Neen series consists of deep, somewhat poorly drained soils on stream terraces and in upland swales. These soils formed in alluvium. Slope is 0 to 2 percent. Elevation is 4,200 to 6,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-silty, mixed, frigid Aquic Calciorthids.

Typical pedon of Neen silty clay loam, 0 to 2 percent slopes, in an area of rangeland, 2,140 feet west and 1,940 feet north of the southeast corner of sec. 25, T. 4 S., R. 7 W.

A11sa—0 to 2 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak to moderate fine and medium granular structure; slightly hard, friable, sticky and plastic; few very fine and fine roots; many very fine interstitial pores; many very fine salt crystals; violently effervescent; moderately alkaline; abrupt smooth boundary.

A12sa—2 to 9 inches; light gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; weak very fine and fine granular structure; slightly hard, friable, sticky and plastic; many very fine roots; many very fine interstitial pores; many very fine salt crystals; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1casa—9 to 32 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; moderate fine granular structure; slightly hard, friable, sticky

and plastic; common very fine roots; common very fine continuous tubular pores; violently effervescent; many very fine salt crystals; moderately alkaline; clear smooth boundary.

C2casa—32 to 50 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine roots; common very fine continuous tubular pores; few very fine salt crystals; violently effervescent; moderately alkaline; clear smooth boundary.

C3cag—50 to 60 inches; light gray (5Y 7/2) silty clay loam, olive gray (5Y 5/2) moist; common fine distinct yellowish red (5YR 4/6) mottles; massive; hard, firm, sticky and plastic; many very fine roots; many very fine interstitial pores; few very fine salt crystals; strongly effervescent; moderately alkaline.

The water table fluctuates between depths of 24 and 42 inches during the growing season. The electrical conductivity is 8 to 16 millimhos per centimeter. Where the profile is drained and irrigated, the conductivity is 2 to 4 millimhos per centimeter in the upper part and 2 to 8 millimhos per centimeter in the lower part. Depth to the Cca horizon is 6 to 30 inches. The C3 horizon is clay loam or silty clay loam.

Nuley Series

The Nuley series consists of deep, well drained soils on uplands. These soils formed in material derived from metamorphic and igneous rock. Slope is 2 to 35 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-loamy, mixed Aridic Argiborolls.

Typical pedon of Nuley clay loam, 2 to 8 percent slopes, in an area of cropland, 2,000 feet west and 25 feet north of the southeast corner of sec. 16, T. 1 S., R. 1 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; weak to moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores and few fine interstitial pores; 5 percent pebbles; mildly alkaline; abrupt smooth boundary.

B2t—7 to 11 inches; brown (10YR 4/3) clay loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine roots; common fine tubular pores; common to many distinct clay films on faces of peds; 5 percent pebbles; mildly alkaline; clear wavy boundary.

B3ca—11 to 15 inches; light gray (10YR 7/2) sandy clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots; few fine tubular pores and common fine interstitial pores; 5 percent pebbles; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—15 to 24 inches; white (10YR 8/1) sandy loam, light gray (10YR 7/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots; common fine tubular pores; 5 percent pebbles; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.

IIC2—24 to 50 inches; grayish brown (2.5Y 5/2) gravelly coarse sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; very few very fine roots; common fine and medium interstitial pores; 25 percent pebbles; moderately effervescent; moderately alkaline; gradual irregular boundary.

R—50 inches; granitic gneiss.

Depth to calcareous material is 10 to 15 inches. Depth to granitic bedrock is 40 to 60 inches. The A and B horizons are 5 to 15 percent rock fragments, mainly pebbles. The A and B2t horizons are neutral or mildly alkaline. The Ap horizon is clay loam or sandy loam. The B2t horizon is mainly clay loam or sandy clay loam and is 20 to 35 percent clay. The IIC horizon is gravelly coarse sand or gravelly loamy coarse sand. It is 25 to 35 percent rock fragments.

Oro Fino Series

The Oro Fino series consists of deep, well drained soils on uplands. These soils formed in colluvium and material derived from gneiss and schist. Slope is 2 to 45 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine-loamy, mixed Argic Cryoborolls.

Typical pedon of an Oro Fino gravelly loam in an area of Oro Fino-Poin complex, 4 to 15 percent slopes, in an area of rangeland, 2,400 feet north and 1,000 feet west of the southeast corner of sec. 13, T. 8 S., R. 7 W.

A11—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak medium platy structure parting to weak fine granular; soft, very friable, nonsticky and slightly plastic; many fine roots; many fine vesicular and tubular pores; 20 percent angular pebbles; neutral; clear smooth boundary.
A12—4 to 10 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate very coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine irregular pores; few fine vesicular and tubular pores; 15 percent angular pebbles; neutral; clear smooth boundary.
B2t—10 to 22 inches; brown (10YR 5/3) gravelly sandy clay loam, dark brown (10YR 4/3) moist; moderate to strong very coarse prismatic structure parting to moderate fine subangular blocky; hard, firm, slightly sticky and plastic; common fine roots; common fine irregular pores; few fine vesicular and tubular pores; common faint clay films on ped faces and in pores; 15 percent angular pebbles; neutral; clear smooth boundary.
C1ca—22 to 34 inches; light gray (10YR 7/2) gravelly loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few to common fine roots; 30 percent angular pebbles; violently effervescent; moderately alkaline; abrupt wavy boundary.
C2ca—34 to 42 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) moist; massive; loose, nonsticky and nonplastic; few to common fine roots; common fine irregular pores; 40 percent angular pebbles; strongly effervescent; mildly alkaline; clear wavy boundary.
C3ca—42 to 60 inches; brown (10YR 5/3) very gravelly loamy sand, dark brown (10YR 4/3) moist; massive; loose, nonsticky and nonplastic; few fine roots; few to common fine irregular pores; 60 percent pebbles; strongly effervescent; mildly alkaline.

Depth to carbonates is 15 to 30 inches. The A horizon is loam or gravelly loam. The fine earth fraction of the B2t horizon ranges from loam to clay loam and is mainly sandy clay loam. The B horizon and the upper part of the C1 horizon are 15 to 35 percent rock fragments. The C horizon is mildly alkaline or moderately alkaline. The C1 horizon is gravelly loam or gravelly sandy loam. The C3 horizon is very gravelly loamy sand or very gravelly sand.

Pensore Series

The Pensore series consists of shallow, well drained soils on uplands and mountains. These soils formed in material derived from limestone. Slope is 8 to 75 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are loamy-skeletal, carbonatic Borollic Lithic Calciorthids.

Typical pedon of a Pensore very channery loam in an area of Pensore-Crago, cool-Rock outcrop complex, 25 to 75 percent slopes, in an area of rangeland, 1,200 feet south and 1,400 feet east of the northwest corner of sec. 22, T. 5 S., R. 7 W.

A1—0 to 4 inches; light brownish gray (10YR 6/2) very channery loam, grayish brown (10YR 5/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; 40 percent channery fragments; strongly effervescent; moderately alkaline; abrupt wavy boundary.
Cca—4 to 16 inches; light gray (10YR 7/2) very channery loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots between fragments; 60 percent channery fragments; channery fragments are coated with lime pendants and powdery lime; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.
R—16 inches; fractured limestone.

Depth to bedrock is 10 to 20 inches. Rock fragment content is 35 to 60 percent. The calcium carbonate equivalent of the fine earth fraction and fragments less than ¾ inch in diameter is 40 to 60 percent.

Poin Series

The Poin series consists of shallow, well drained soils on uplands. These soils formed in colluvium and material derived from gneiss, schist, rhyolite, and welded tuff. Slope is 4 to 60 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Lithic Cryoborolls.

Typical pedon of a Poin very flaggy sandy loam in an

area of Poin-Rock outcrop complex, 4 to 15 percent slopes, in an area of rangeland, 2,500 feet north and 1,900 feet east of the southwest corner of sec. 4, T. 2 S., R. 7 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) very flaggy sandy loam, very dark brown (10YR 2/2) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; 15 percent flagstones and 25 percent channery fragments; neutral; abrupt wavy boundary.
B21—5 to 12 inches; brown (10YR 5/3) very channery sandy loam, brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; 15 percent flagstones and 45 percent channery fragments; neutral; clear smooth boundary.
B22—12 to 19 inches; pale brown (10YR 6/3) extremely channery sandy loam, brown (10YR 5/3) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; 20 percent flagstones and 60 percent channery fragments; neutral; clear smooth boundary.
R—19 inches; fractured gneiss and schist.

Depth to massive or fractured bedrock is 10 to 20 inches. The profile is 35 to 90 percent rock fragments, of which 10 to 25 percent is flagstones and stones. The A horizon is 3 to 8 inches thick.

Raynesford Series

The Raynesford series consists of deep, well drained soils on fans and foot slopes. These soils formed in alluvium and colluvium derived from limestone. Slope is 2 to 35 percent. Elevation is 5,000 to 7,500 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are fine-loamy, carbonatic Calcic Cryoborolls.

Typical pedon of a Raynesford stony silt loam in an area of Hanson-Raynesford complex, 8 to 35 percent slopes, in an area of rangeland, 1,100 feet north and 800 feet west of the southeast corner of sec. 18, T. 4 S., R. 3 E.

A1—0 to 16 inches; very dark gray (10YR 3/1) stony silt loam, black (10YR 2/1) moist; moderate coarse and medium granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 5 percent stones and 10 percent pebbles; mildly alkaline; abrupt smooth boundary.
C1ca—16 to 20 inches; light gray (10YR 7/2) gravelly silt loam, grayish brown (10YR 5/2) moist; moderate medium and fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; 20 percent pebbles; lime coatings on pebbles and disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.
C2ca—20 to 30 inches; white (10YR 8/2) gravelly silty clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; 20 percent pebbles; lime coatings on pebbles and disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.
C3ca—30 to 60 inches; light gray (10YR 7/2) gravelly silty clay loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; 30 percent pebbles; lime coatings on pebbles and disseminated lime; violently effervescent; moderately alkaline.

Rock fragment content is 5 to 15 percent in the A horizon and 5 to 35 percent in the C horizon; content of stones in the C horizon is less than 5 percent. The A horizon is 8 to 16 inches thick and has a fine earth fraction of loam or silt loam. The fine earth fraction of the Cca horizon is silt loam, silty clay loam, or clay loam. The Cca horizon has a calcium carbonate equivalent of 40 to 50 percent in the fraction less than ¾ inch in diameter.

Redchief Variant

The Redchief Variant consists of deep, well drained soils on hills, terraces, and foot slopes. These soils formed in alluvium and glacial drift derived from igneous rock. Slope is 8 to 25 percent. Elevation is 7,000 to 7,500 feet. The average annual precipitation is 20 to 24 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are clayey-skeletal, mixed Argic Cryoborolls.

Typical pedon of a Redchief Variant loam in an area of Redchief Variant-Hapgood, moist, complex, 8 to 25 percent slopes, in an area of rangeland, 2,700 feet north and 900 feet east of the southwest corner of sec. 11, T. 13 S., R. 1 W.

A11—0 to 6 inches; dark grayish brown (10YR 4/2)

loam, black (10YR 2/1) moist; weak medium and fine granular structure; soft, very friable, slightly sticky and plastic; many very fine and fine roots and common medium roots; 10 percent pebbles; neutral; clear wavy boundary.

A12—6 to 12 inches; dark brown (10YR 4/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; soft, friable, slightly sticky and plastic; many very fine and fine roots and common medium roots; 20 percent pebbles; neutral; gradual wavy boundary.

B&A—12 to 20 inches; pale brown (10YR 6/3) cobbly sandy clay loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and plastic; common very fine and fine roots; few moderately thick clay films lining pores; many coatings of clear sand grains on faces of peds; 10 percent cobbles and 15 percent pebbles; neutral; gradual wavy boundary.

B2t—20 to 45 inches; brown (7.5YR 5/4) very gravelly clay, dark brown (10YR 4/3) moist; strong coarse prismatic structure parting to strong coarse and medium angular blocky; very hard, very firm, very sticky and very plastic; few very fine and fine roots; many thick dark reddish brown (5YR 3/4, moist) clay films on faces of peds and lining pores; 5 percent cobbles and 35 percent pebbles; neutral; gradual wavy boundary.

C1—45 to 60 inches; light brownish gray (10YR 6/2) very gravelly clay loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, sticky and plastic; few very fine and fine roots; 40 percent pebbles; neutral.

Reaction is neutral or slightly acid throughout the profile. The A horizon is 10 to 16 inches thick. The upper part of the A horizon is 0 to 15 percent rock fragments, and the lower part is 15 to 25 percent rock fragments. The Bt horizon ranges from 20 inches to more than 50 inches in thickness. The fine earth fraction is clay or clay loam and averages 35 to 50 percent clay.

Rentsac Series

The Rentsac series consists of shallow, well drained soils on upland hills and ridges. These soils formed in material derived from calcareous sandstone, basalt, gneiss, and schist. Slope is 8 to 75 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are loamy-skeletal, mixed (calcareous), frigid Lithic Ustic Torriorthents.

Typical pedon of a Rentsac channery loam in an area of Rentsac-Varney complex, 8 to 45 percent slopes, in an area of rangeland, 100 feet south and 100 feet east of the northwest corner of sec. 12, T. 1 S., R. 3 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) channery loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; few to common fine and medium roots; common fine and medium interstitial pores; 20 percent channery fragments and 5 percent flagstones; mildly alkaline; slightly effervescent; clear wavy boundary.

C1ca—4 to 16 inches; light brownish gray (10YR 6/2) very channery loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; few fine and medium roots; few to common fine interstitial pores; 45 percent channery fragments and 15 percent flagstones; moderately alkaline; disseminated lime; violently effervescent; abrupt smooth boundary.

R—16 inches; hard, fractured sandstone.

Depth to bedrock is 10 to 20 inches. The A horizon is channery sandy loam, channery loam, or very channery loam. The Cca horizon is 35 to 60 percent rock fragments. The calcium carbonate equivalent is 5 to 15 percent.

Rivra Series

The Rivra series consists of deep, well drained soils on fans and low terraces. These soils formed in mixed alluvium. Slope is 0 to 4 percent. Elevation is 4,200 to 6,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are sandy-skeletal, mixed, frigid Ustic Torrifluvents.

Typical pedon of a Rivra gravelly sandy loam in an area of Rivra-Ryell-Havre complex, cool, 0 to 2 percent slopes, in an area of rangeland, 1,500 feet north and 800 feet west of the southeast corner of sec. 10, T. 1 N., R. 3 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; moderate very fine platy structure parting to

moderate fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine pores; 25 percent pebbles; slightly effervescent; mildly alkaline; abrupt smooth boundary.

AC—4 to 12 inches; grayish brown (2.5Y 5/2) extremely gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; common very fine and fine roots; 65 percent pebbles; few thin lime coatings on undersides of fragments; slightly effervescent; mildly alkaline; gradual wavy boundary.

C1—12 to 60 inches; grayish brown (2.5Y 5/2) extremely gravelly sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; 75 percent pebbles; few thin lime coatings on undersides of fragments; slightly effervescent; mildly alkaline.

Gravelly and sandy material is at a depth of 5 to 15 inches. The A horizon is sandy loam, gravelly sandy loam, or very gravelly sandy loam. It is 10 to 60 percent rock fragments, of which 0 to 10 percent is cobbles. The C horizon is extremely gravelly loamy sand, extremely gravelly coarse sand, or extremely gravelly sand. It is 60 to 80 percent rock fragments. Reaction is mildly alkaline or moderately alkaline. In some pedons the profile is noncalcareous below a depth of about 40 inches.

Rochester Series

The Rochester series consists of deep, excessively drained soils on mountainsides. These soils formed in colluvium derived from gneiss, schist, and granite. Slope is 25 to 70 percent. Elevation is 5,000 to 7,800 feet. The average annual precipitation is 18 to 25 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 75 to 105 days.

These soils are sandy-skeletal, mixed, frigid Typic Ustorthents.

Typical pedon of a Rochester very stony loamy sand in an area of Rochester-Rock outcrop complex, 35 to 70 percent slopes, in an area of woodland, 2,300 feet north and 100 feet east of the southwest corner of sec. 35, T. 5 S., R. 1 E.

O1—2 inches to 0; fresh and partially decomposed forest litter of needles, twigs, and cones.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) very stony loamy sand, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine, medium, and coarse roots; many fine pores; 10 percent stones, 15 percent cobbles, and 30 percent pebbles; neutral; abrupt smooth boundary.

C1—3 to 14 inches; pale brown (10YR 6/3) very stony loamy sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots and few coarse roots; many fine pores; 15 percent stones, 15 percent cobbles, and 30 percent pebbles; neutral; clear smooth boundary.

C2—14 to 60 inches; light brownish gray (2.5Y 6/2) very stony loamy sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose, nonsticky and nonplastic; few fine, medium, and coarse roots; 15 percent stones, 15 percent cobbles, and 30 percent pebbles; neutral.

Rock fragment content ranges from 35 to 70 percent. The A1 horizon is 5 to 10 percent stones, the B2 horizon is 10 to 20 percent stones, and the C1 horizon is 15 to 20 percent stones. The C1 horizon is neutral or mildly alkaline.

Ryell Series

The Ryell series consists of deep, well drained soils on flood plains, fans, and low terraces. These soils formed in alluvium. Slope is 0 to 2 percent. Elevation is 4,200 to 6,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are coarse-loamy over sandy or sandy-skeletal, mixed (calcareous) Ustic Torrifluvents.

Typical pedon of a Ryell loam in an area of Ryell-Rivra complex, cool, 0 to 2 percent slopes, in an area of cropland, 850 feet south and 150 feet east of the northwest corner of sec. 4, T. 2 S., R. 5 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots and common medium roots; strongly effervescent; mildly alkaline; abrupt wavy boundary.

C1—7 to 23 inches; light gray (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and slightly plastic; common very fine and fine roots and few medium roots; violently effervescent; mildly alkaline; abrupt wavy boundary.

IIC2—23 to 60 inches; extremely gravelly loamy sand;

single grain; loose; 70 percent rock fragments; slightly effervescent; mildly alkaline.

Gravelly and sandy material is at a depth of 20 to 30 inches. The Ap horizon is loam or sandy loam. The C1 horizon is loam, silt loam, or fine sandy loam. Depth to the IIC horizon is 20 to 30 inches. The IIC horizon has a fine earth fraction of loamy sand or sand. It is 45 to 70 percent rock fragments, mainly pebbles.

Saunders Series

The Saunders series consists of deep, poorly drained soils on stream terraces. These soils formed in alluvium. Slope is 0 to 2 percent. Elevation is 4,800 to 6,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-silty, frigid Aeric Calciaquolls.

Typical pedon of Saunders silty clay loam, reclaimed, 0 to 2 percent slopes, in an area of hayland, 1,300 feet south and 1,800 feet east of the northwest corner of sec. 35, T. 5 S., R. 1 W.

A11—0 to 5 inches; gray (10YR 5/1) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine platy structure; hard, firm, sticky and plastic; few coarse roots and many fine and very fine roots; many very fine interstitial pores; strongly effervescent; moderately alkaline; abrupt smooth boundary.

A12—5 to 14 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium angular blocky structure; hard, firm, sticky and plastic; few coarse roots and common fine and very fine roots; common very fine interstitial pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C1ca—14 to 26 inches; gray (10YR 6/1) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine subangular blocky structure; very hard, firm, sticky and plastic; few coarse roots and common fine and very fine roots; common very fine tubular pores; common fine soft masses of lime and disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.

C2ca—26 to 32 inches; gray (10YR 6/1) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate very fine granular structure; very hard, firm, sticky and plastic; few coarse roots and common fine and very fine roots; common very fine interstitial pores; common fine soft masses of lime and disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.

C3g—32 to 45 inches; light gray (2.5Y 7/1) silty clay, gray (2.5Y 5/1) moist; few fine distinct light olive brown (2.5Y 5/4, moist) mottles; massive; very hard, very firm, sticky and plastic; few fine and very fine roots; few fine tubular pores; strongly effervescent; strongly alkaline; clear irregular boundary.

C4g—45 to 60 inches; gray (5Y 6/1) clay, dark gray (10YR 4/1) moist; massive; very hard, extremely firm, very sticky and very plastic; few fine and very fine roots; few fine tubular pores; few fine soft masses of lime; strongly effervescent; strongly alkaline.

Depth to the high water table is 12 to 24 inches. Coarse fragment content of the profile is 0 to 5 percent. Reaction is moderately alkaline in the upper part of the profile and is moderately alkaline or strongly alkaline below a depth of 30 inches. In reclaimed areas, electrical conductivity is less than 4 millimhos per centimeter throughout the profile and depth to the high water table is 36 to 60 inches. In some pedons there is a horizon of salt accumulation at a depth of 30 to 40 inches. In unreclaimed areas electrical conductivity is 8 to 16 millimhos per centimeter in the upper 14 inches and is 4 to 8 millimhos per centimeter below a depth of 14 inches. Calcium carbonate equivalent in the Cca horizon is 15 to 35 percent. The Cg horizon is clay, silty clay, or clay loam.

Scravo Series

The Scravo series consists of deep, well drained soils on fans and terraces. These soils formed in gravelly and cobbly alluvium. Slope is 0 to 45 percent. Elevation is 4,500 to 5,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are sandy-skeletal, mixed Borollic Calciorthids.

Typical pedon of a Scravo cobbly sandy loam in an area of Scravo-Thess complex, cool, 0 to 4 percent slopes, in an area of rangeland, 1,200 feet north and 650 feet west of the southeast corner of sec. 17, T. 4 S., R. 5 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) cobbly sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; many coarse

roots; 10 percent pebbles and 10 percent cobbles; mildly alkaline; clear wavy boundary.

C1ca—5 to 17 inches; light gray (10YR 7/2) very cobbly sandy loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; common medium and fine roots and few coarse roots; 30 percent pebbles and 20 percent cobbles; lime coatings on rock fragments; common soft masses of lime; violently effervescent; moderately alkaline; clear wavy boundary.

IIC2ca—17 to 42 inches; pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 4/3) moist; single grain; loose; common very fine roots; 40 percent pebbles and 15 percent cobbles; lime coatings on fragments and disseminated lime; strongly effervescent; moderately alkaline; clear wavy boundary.

IIC3—42 to 60 inches; very pale brown (10YR 7/3) extremely gravelly sand with strata of loamy sand, brown (10YR 5/3) moist; single grain; loose; few very fine roots; 50 percent pebbles and 20 percent cobbles; moderately alkaline.

The A1 horizon is sandy loam, cobbly sandy loam, or very cobbly sandy loam. The C1 horizon has a fine earth fraction of loam or sandy loam. The C1 horizon is 35 to 60 percent rock fragments. The IIC horizon is at a depth of 9 to 18 inches. It is 50 to 70 percent rock fragments and has a fine earth fraction of loamy sand or sand.

Sebud Series

The Sebud series consists of deep, well drained soils on mountainsides, hillsides, ridges, and moraines. These soils formed in colluvium and glacial till derived from igneous and metamorphic rock. Slope is 8 to 60 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 15 to 24 inches, the average annual air temperature is 34 to 38 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Typic Cryoborolls.

Typical pedon of a Sebud very stony loam in an area of Sebud-Hapgood complex, 8 to 45 percent slopes, in an area of rangeland, 1,400 feet north and 2,600 feet west of the southeast corner of sec. 31, T. 1 S., R. 7 W.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) very stony loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine and fine pores; 10 percent stones and cobbles and 10 percent pebbles; neutral; clear wavy boundary.

A12—6 to 14 inches; dark brown (10YR 3/3) stony loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; many very fine pores; 10 percent stones and cobbles and 10 percent pebbles; neutral; clear wavy boundary.

B21—14 to 30 inches; yellowish brown (10YR 5/4) very stony sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine pores; 20 percent stones and cobbles and 20 percent pebbles; neutral; clear wavy boundary.

B22—30 to 46 inches; light yellowish brown (10YR 6/4) very stony coarse sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few very fine and fine roots; many very fine pores; 20 percent stones and cobbles and 20 percent pebbles; neutral; clear wavy boundary.

C1—46 to 60 inches; pale brown (10YR 6/3) very stony coarse sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and nonplastic; few very fine and fine roots; common very fine pores; 20 percent stones and cobbles and 20 percent pebbles; mildly alkaline.

The A horizon is 6 to 14 inches thick. It is 15 to 45 percent pebbles, cobbles, or stones. The A horizon is neutral or mildly alkaline. The fine earth fraction is loam or sandy loam. The B horizon is 35 to 60 percent rock fragments. The fine earth fraction is sandy clay loam, loam, coarse sandy loam, or sandy loam. The B horizon is neutral or mildly alkaline. The C horizon is sandy loam or coarse sandy loam and is 35 to 60 percent rock fragments. It is neutral or mildly alkaline.

The Sebud soil in map unit 120 is taxadjunct to the series because it has a slightly warmer mean summer soil temperature than is defined in the range for the series. This difference, however, does not significantly affect use and management.

Shadow Series

The Shadow series consists of deep, somewhat excessively drained soils on moraines and

mountainsides and in glaciated valleys. These soils formed in colluvium and glacial till derived from gneiss, schist, and granite. Slope is 15 to 70 percent. Elevation is 6,000 to 8,500 feet. The average annual precipitation is 20 to 40 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is less than 60 days.

These soils are loamy-skeletal, mixed Typic Cryochrepts.

Typical pedon of a Shadow very channery sandy loam in an area of Shadow complex, warm, 15 to 45 percent slopes, in an area of woodland, 150 feet south and 2,550 feet east of the northwest corner of sec. 13, T. 8 S., R. 1 E.

Oi—1 inch to 0; mostly decomposed forest litter.

A1—0 to 3 inches; brown (10YR 5/3) very channery sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and coarse roots; many fine pores; 45 percent channery fragments and 15 percent flagstones; slightly acid; clear wavy boundary.

A2—3 to 17 inches; pale brown (10YR 6/3) very channery sandy loam, brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; common fine, medium, and coarse roots; common fine pores; 50 percent channery fragments; slightly acid; clear wavy boundary.

B2—17 to 30 inches; brown (10YR 5/3) extremely channery sandy loam, brown (10YR 4/3) moist; weak fine blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine roots; common fine pores; 65 percent channery fragments; neutral; gradual smooth boundary.

C—30 to 60 inches; pale brown (10YR 6/3) extremely channery sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; 70 percent channery fragments; neutral.

Reaction is slightly acid or neutral in the upper 17 inches and is slightly acid to mildly alkaline below a depth of 17 inches. The A horizon is 10 to 80 percent rock fragments. The fine earth fraction is sandy loam or loam that is 5 to 15 percent clay.

Shedhorn Series

The Shedhorn series consists of deep, moderately well drained soils on moraines, mountainsides, and foot slopes. These soils formed in colluvium or glacial till derived from shale or sandstone. Slope is 8 to 70 percent. Elevation is 6,000 to 9,500 feet. The average annual precipitation is 25 to 50 inches, the average annual air temperature is 34 to 38 degrees F, and the frost-free period is less than 60 days.

These soils are fine, mixed Typic Cryoborolls.

Typical pedon of Shedhorn clay loam, 8 to 25 percent slopes, in an area of native grassland, 2,200 feet north and 1,700 feet east of the southwest corner of sec. 7, T. 8 S., R. 2 E.

A11—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots and common coarse roots; many very fine interstitial pores; 5 percent angular sandstone pebbles; slightly acid; abrupt smooth boundary.

A12—4 to 12 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable, sticky and plastic; many very fine roots and common coarse roots; many very fine interstitial pores; 5 percent angular shale and sandstone pebbles; slightly acid; clear smooth boundary.

B2—12 to 40 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots and few coarse roots; common fine and very fine interstitial pores; thin very dark grayish brown (2.5Y 3/2, moist) organic coatings on faces of peds; 10 percent angular shale and sandstone pebbles; slightly acid; clear smooth boundary.

C1—40 to 60 inches; dark grayish brown (2.5Y 4/2) shaly clay loam, very dark grayish brown (2.5Y 3/2) moist; weak fine subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; common fine and very fine interstitial pores; 30 percent angular shale pebbles; neutral.

The A horizon is 4 to 16 inches thick. It is loam or clay loam in the upper part and is clay loam in the lower part; it is 27 to 35 percent clay when mixed. The horizon is 0 to 15 percent shale and sandstone pebbles. The B horizon is clay or clay loam and is 35 to 45 percent clay. It is 5 to 35 percent shale and sandstone fragments. It is slightly acid or neutral. Depth to the C horizon is 40 to 48 inches. The C horizon is clay or clay loam and is 35 to 45 percent clay. It is 10 to 35 percent

rock fragments, mainly shale. It is neutral or mildly alkaline.

Shurley Series

The Shurley series consists of deep, well drained soils on hills, foot slopes, mountainsides, and fans. These soils formed in material derived from gneiss, schist, and granite. Slope is 8 to 60 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are sandy-skeletal, mixed Borollic Camborthids.

Typical pedon of a Shurley very flaggy coarse sandy loam in an area of Shurley-Rock outcrop complex, 25 to 60 percent slopes, in an area of rangeland, 2,500 feet east and 300 feet south of the northwest corner of sec. 8, T. 3 S., R. 1 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) very flaggy coarse sandy loam, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; loose; nonsticky and nonplastic; many fine and very fine roots; 20 percent flagstones and 20 percent channery fragments; mildly alkaline; clear smooth boundary.

B2—4 to 10 inches; pale brown (10YR 6/3) very flaggy coarse sandy loam, brown (10YR 4/3) moist; weak medium angular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; many fine and very fine roots; 20 percent flagstones and 20 percent channery fragments; mildly alkaline; clear irregular boundary.

C1ca—10 to 29 inches; light gray (10YR 7/2) very flaggy loamy coarse sand, grayish brown (10YR 5/2) moist; massive; slightly hard and very friable; nonsticky and nonplastic; common fine and very fine roots; 20 percent flagstones and 20 percent channery fragments; thin coatings of lime on fragments; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—29 to 60 inches; very pale brown (10YR 7/3) very flaggy loamy sand, light yellowish brown (10YR 6/4) moist; single grain; loose, very friable, nonsticky and nonplastic; few fine and very fine roots; 20 percent flagstones and 40 percent channery fragments; mildly alkaline.

Depth to carbonates ranges from 10 to 24 inches but is mainly 10 to 15 inches. The A and B horizons are 40 to 60 percent rock fragments, of which 20 to 30 percent is fragments larger than 3 inches in diameter. These horizons are neutral to moderately alkaline. The fine earth fraction of the C horizon is loamy coarse sand or loamy sand that has thin strata of sandy loam or sandy clay loam in some pedons. The C horizon is 40 to 85 percent rock fragments, of which 20 to 40 percent is fragments larger than 3 inches in diameter. The C horizon is mildly alkaline or moderately alkaline.

Thess Series

The Thess series consists of deep, well drained soils on fans and terraces. These soils formed in alluvium. They are underlain by sand and gravel at a depth of 20 to 30 inches. Slope is 0 to 8 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Borollic Calciorthids.

Typical pedon of a Thess loam in an area of Scravo-Thess complex, cool, 0 to 4 percent slopes, in an area of cropland, 2,200 feet north and 900 feet west of the southeast corner of sec. 22, T. 4 S., R. 5 W.

Ap—0 to 7 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; strong medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few coarse roots; 5 percent pebbles; strongly effervescent; moderately alkaline; abrupt wavy boundary.

C1ca—7 to 19 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine roots and few medium roots; 5 percent pebbles; violently effervescent; moderately alkaline; abrupt smooth boundary.

C2ca—19 to 30 inches; very pale brown (10YR 7/3) gravelly loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; 25 percent pebbles; violently effervescent; moderately alkaline; clear wavy boundary.

IIC3—30 to 60 inches; gray (10YR 5/1) very gravelly sand; single grain; loose; nonsticky and nonplastic; 50 percent pebbles; mildly alkaline.

In areas not cultivated, the profile has a 2- to 4-inch-thick A horizon that is leached of carbonates. The Ap horizon is loam or sandy loam. Depth to the IIC horizon

is 20 to 30 inches. The Cca horizon is loam or sandy loam and is 0 to 30 percent rock fragments. The IIC horizon is 50 to 80 percent rock fragments, mainly pebbles. The fine earth fraction is sand or loamy sand.

Thess soils in this survey area are taxadjunct to the series because they have as much as 30 percent rock fragments and have less than 18 percent noncarbonate clay in the Cca horizon. These differences, however, do not significantly affect use and management.

Tiban Series

The Tiban series consists of deep, well drained soils on foot slopes, hillsides, terraces, and moraines. These soils formed in glacial till, colluvium, and alluvium. Slope is 2 to 45 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Typic Cryoborolls.

Typical pedon of Tiban cobbly loam, 2 to 15 percent slopes, in an area of rangeland, 400 feet north and 200 feet east of the southwest corner of sec. 15, T. 6 S., R. 3 W.

A1—0 to 8 inches; brown (10YR 5/3) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and plastic; 10 percent pebbles and 10 percent cobbles; neutral; clear smooth boundary.

B2—8 to 14 inches; grayish brown (10YR 5/2) cobbly loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; 10 percent pebbles and 10 percent cobbles; mildly alkaline; clear smooth boundary.

C1ca—14 to 18 inches; very pale brown (10YR 7/3) very cobbly loam, brown (10YR 5/3) moist; moderate coarse subangular blocky structure; slightly hard, friable, sticky and plastic; 20 percent pebbles and 15 percent cobbles; disseminated lime and few fine soft masses of lime; strongly effervescent; moderately alkaline; clear smooth boundary.

C2ca—18 to 30 inches; very pale brown (10YR 8/3) very cobbly loam, pale brown (10YR 6/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; 30 percent pebbles and 20 percent cobbles; coarse fragments are lime coated and have lime pendants; common fine soft masses of lime; violently effervescent; moderately alkaline; clear smooth boundary.

C3ca—30 to 60 inches; pale brown (10YR 6/3) very cobbly loam, yellowish brown (10YR 5/4) moist; weak very fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; 30 percent pebbles and 20 percent cobbles; coarse fragments are lime coated and have lime pendants; few fine soft masses of lime; violently effervescent; moderately alkaline.

Stones, cobbles, and pebbles are distributed throughout the profile, and their content increases with increasing depth. The A horizon is 7 to 13 inches thick. The A and B horizons are 15 to 50 percent rock fragments. The fine earth fraction is loam, and it is 18 to 27 percent clay. Depth to the Cca horizon is 10 to 20 inches. The Cca horizon is 35 to 60 percent rock fragments.

Tineman Series

The Tineman series consists of deep, well drained soils on fans, terraces, and foot slopes. These soils formed in alluvium derived from gneiss, schist, and igneous rock. Slope is 2 to 25 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 15 to 24 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Typic Cryoborolls.

Typical pedon of a Tineman gravelly loam, 2 to 8 percent slopes, in an area of rangeland, 500 feet north and 100 feet west of the southeast corner of sec. 12, T. 11 S., R. 1 E.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial pores; 15 percent pebbles; neutral; clear wavy boundary.

B21—7 to 13 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and fine roots; common very fine pores; 30 percent pebbles and 10 percent cobbles; neutral; abrupt wavy boundary.

B22—13 to 28 inches; yellowish brown (10YR 5/4) very gravelly sandy clay loam, dark yellowish brown

(10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots; common very fine pores; 30 percent pebbles and 10 percent cobbles; neutral; clear wavy boundary.

IIC—28 to 60 inches; yellowish brown (10YR 5/4) very gravelly loamy sand, dark brown (10YR 4/3) moist; weak fine granular structure; loose; nonsticky and nonplastic; few very fine and fine roots; 45 percent pebbles and 10 percent cobbles; neutral.

Depth to the very gravelly loamy sand IIC horizon is 20 to 40 inches. The A horizon is gravelly loam or cobbly loam and is 15 to 35 percent rock fragments. The B horizon is 35 to 60 percent rock fragments and is very gravelly or very cobbly. The fine earth fraction of the B horizon is loam in the upper part and is sandy clay loam or sandy loam in the lower part. The A and B horizons are slightly acid or neutral. The IIC horizon is neutral or slightly alkaline.

Trimad Series

The Trimad series consists of deep, well drained soils on fans and terraces on uplands. These soils formed in gravelly and cobbly alluvium. Slope is 2 to 45 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are loamy-skeletal, mixed Aridic Calciborolls.

Typical pedon of Trimad cobbly loam, 2 to 8 percent slopes, in an area of rangeland, 400 feet north and 2,000 feet east of the southwest corner of sec. 8, T. 6 S., R. 1 E.

A1—0 to 2 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine irregular pores; 10 percent cobbles and 10 percent pebbles; neutral; clear smooth boundary.

B2—2 to 6 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to fine strong subangular blocky; hard, friable, sticky and plastic; many fine roots; many very fine irregular and tubular pores; 10 percent cobbles and 15 percent pebbles; neutral; clear smooth boundary.

B3ca—6 to 9 inches; light gray (10YR 7/2) gravelly loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common very fine irregular and tubular pores; 15 percent pebbles and 5 percent cobbles; lime coatings on pebbles and cobbles and disseminated lime; strongly effervescent; mildly alkaline; clear smooth boundary.

C1ca—9 to 18 inches; light gray (10YR 7/2) very gravelly loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; common fine vesicular pores and few very fine tubular pores; 30 percent pebbles and 10 percent cobbles; lime coatings on pebbles and cobbles and disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.

C2ca—18 to 60 inches; light brownish gray (10YR 6/2) extremely gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many fine irregular pores; 50 percent pebbles and 20 percent cobbles; lime coatings on pebbles and cobbles and disseminated lime; strongly effervescent; mildly alkaline.

Depth to carbonates is 4 to 7 inches. The A and B2 horizons are mildly alkaline or neutral, and the B3 horizon is mildly alkaline or moderately alkaline. The C horizon is very gravelly loam, extremely gravelly loam, very sandy loam, or extremely gravelly sandy loam, and it becomes coarser textured as depth increases. The C horizon is 35 to 70 percent rock fragments, of which 0 to 5 percent is stones, 10 to 20 percent is cobbles, and 25 to 50 percent is pebbles. The C horizon is mildly alkaline or moderately alkaline.

Trudau Series

The Trudau series consists of deep, well drained soils on fans, foot slopes, and terraces of sedimentary uplands. These soils formed in alluvium derived from sandstone, siltstone, and shale. Slope is 2 to 8 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-loamy, mixed Borollic Camborthids.

Typical pedon of Trudau loam, 2 to 8 percent slopes, in an area of rangeland, 1,200 feet north and 1,200 feet

west of the southeast corner of sec. 22, T. 8 S., R. 5 W.

A1—0 to 2 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak very fine platy structure parting to moderate very fine granular; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many fine tubular pores; strongly effervescent; strongly alkaline; abrupt smooth boundary.

B2—2 to 14 inches; light gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine irregular and tubular pores; few fine soft masses of lime; strongly effervescent; strongly alkaline; gradual smooth boundary.

B3ca—14 to 30 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many irregular and tubular pores; common fine and medium soft masses of lime; violently effervescent; strongly alkaline; clear wavy boundary.

Ccasa—30 to 60 inches; very pale brown (10YR 7/3) loam stratified with sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly sticky and nonplastic; few fine roots; many irregular pores; common fine salt crystals; common fine and medium soft masses of lime; violently effervescent; moderately alkaline.

The solum is 0 to 5 percent rock fragments. The profile is mainly moderately alkaline or strongly alkaline, but it is mildly alkaline in the slightly saline areas. The profile commonly is moderately saline, but it becomes slightly saline when it is irrigated and salts are leached to a depth of 30 inches or more. The A horizon is 2 to 8 inches thick. The B horizon is loam or clay loam. The C horizon is loam and has thin strata of sandy loam and clay loam. It is 0 to 15 percent rock fragments.

Varney Series

The Varney series consists of deep, well drained soils on terraces, fans, foot slopes, and hills. These soils formed in alluvium. Slope is 2 to 45 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-loamy, mixed Aridic Argiborolls.

Typical pedon of Varney clay loam, 2 to 8 percent slopes, in an area of cropland, 2,400 feet north and 2,300 feet west of the southeast corner of sec. 32, T. 2 S., R. 1 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine and very fine interstitial pores; 5 percent pebbles; neutral; clear smooth boundary.

B2t—5 to 16 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; many fine and very fine roots; common fine tubular pores; many thin continuous clay films on faces of peds; 10 percent pebbles; neutral; clear irregular boundary.

C1ca—16 to 28 inches; light gray (10YR 7/2) gravelly sandy clay loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky and nonplastic; common fine and very fine roots; common fine and very fine pores; 15 percent pebbles and 5 percent cobbles; common fine soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

C2ca—28 to 48 inches; very pale brown (10YR 7/3) gravelly sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly sticky and nonplastic; few fine roots; few fine pores; 15 percent pebbles and 5 percent cobbles; disseminated lime; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—48 to 60 inches; light brown (7.5YR 6/4) stratified gravelly sandy loam and gravelly loamy sand, brown (7.5YR 5/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; few fine roots; few fine pores; 20 percent pebbles and 5 percent cobbles; slightly effervescent; moderately alkaline.

Depth to lime is 9 to 20 inches. The profile is 5 to 30 percent rock fragments. The Ap horizon is clay loam, gravelly clay loam, or cobbly clay loam. Where these soils are not cultivated, there is a 2- to 4-inch-thick A horizon of loam or gravelly loam. The fine earth fraction of the B horizon is clay loam or sandy clay loam. The C1 and C2 horizons have a fine earth fraction of sandy clay loam, loam, or sandy loam. The C3 horizon is gravelly loamy sand or gravelly sandy loam that has

strata of gravelly loam or sandy loam.

Villy Series

The Villy series consists of deep, poorly drained soils on bottom lands and low terraces. These soils formed in stratified alluvium. Slope is 0 to 2 percent. Elevation is 4,200 to 6,000 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 45 degrees F, and the frost-free period is 90 to 105 days.

These soils are fine-silty, mixed (calcareous), frigid Typic Fluvaquents.

Typical pedon of Villy silty clay loam, cool, 0 to 2 percent slopes, in an area of rangeland, 250 feet north and 1,800 feet east of the southwest corner of sec. 35, T. 2 S., R. 6 W.

A11—0 to 3 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and plastic; violently effervescent; moderately alkaline; abrupt smooth boundary.

A12—3 to 10 inches; light gray (10YR 7/1) silty clay loam, gray (10YR 5/1) moist; weak medium granular structure; slightly hard, very friable, sticky and plastic; violently effervescent; moderately alkaline; clear wavy boundary.

C1g—10 to 21 inches; light gray (5Y 7/1) silty clay loam, gray (N 6/0) moist; moderate medium and thick platy structure; hard, friable, sticky and plastic; violently effervescent; moderately alkaline; abrupt wavy boundary.

A1bg—21 to 42 inches; dark gray (5Y 4/1) silty clay loam, black (N 2/0) moist; massive; hard, friable, sticky and plastic; slightly effervescent; moderately alkaline; clear wavy boundary.

C2g—42 to 60 inches; gray (5Y 6/1) very fine sandy loam, dark gray (5Y 4/1) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; moderately alkaline.

Where these soils are not cultivated, there is a 1- to 2-inch-thick organic root mat on the surface. The C horizon is silty clay loam, silt loam, or very fine sandy loam and has thin strata of clay loam, loam, or sandy loam.

Whitecow Series

The Whitecow series consists of deep, well drained soils on south-facing mountainsides. These soils formed in limestone colluvium. Slope is 25 to 70 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 20 to 25 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 80 to 100 days.

These soils are loamy-skeletal, carbonatic, frigid Typic Ustochrepts.

Typical pedon of a Whitecow extremely channery loam in an area of Whitecow-Rock outcrop complex, 25 to 70 percent slopes, in an area of coniferous woodland, 100 feet south and 600 feet west of the northeast corner of sec. 3, T. 6 S., R. 5 W.

O1—2 inches to 0; fresh and partially decomposed twigs and needles; abrupt wavy boundary.

A2—0 to 9 inches; light brownish gray (10YR 6/2) extremely channery loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many fine pores; 65 percent channery fragments; patchy lime concretions coating undersides of fragments; strongly effervescent; moderately alkaline; clear wavy boundary.

Bca—9 to 20 inches; light gray (10YR 7/2) very channery loam, dark grayish brown (10YR 4/2) moist; weak fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots and few coarse roots; many fine pores; 55 percent channery fragments; lime concretions coating all sides of fragments; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.

Cca—20 to 60 inches; light gray (10YR 7/2) extremely channery loam, pale brown (10YR 6/3) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots that decrease in number as depth increases; common fine pores; 70 percent channery fragments; patchy lime concretions on fragments; disseminated lime; violently effervescent; moderately alkaline.

Rock fragment content ranges from 60 to 70 percent in the A horizon, from 50 to 80 percent in the Bca horizon, and from 60 to 80 percent in the Cca horizon. Depth to the Bca horizon ranges from 5 to 12 inches. The fine earth fraction of the Bca and Cca horizons is loam or clay loam.

Whitore Series

The Whitore series consists of deep, well drained

soils on foot slopes, fans, mountainsides, and moraines. These soils formed in colluvium and glacial till derived from limestone and strongly calcareous sandstone. Slope is 15 to 70 percent. Elevation is 6,000 to 8,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 30 to 60 days.

These soils are loamy-skeletal, carbonatic Typic Cryochrepts.

Typical pedon of a Whitore channery loam in an area of Whitore-Rock outcrop complex, 25 to 70 percent slopes, in an area of coniferous woodland, 100 feet south and 600 feet west of the northeast corner of sec. 15, T. 3 S., R. 5 W.

O1—2 inches to 0; fresh and partially decomposed twigs and needles; abrupt smooth boundary.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) channery loam, very dark gray (10YR 3/1) moist; weak very fine granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common fine and medium pores; 25 percent channery fragments; mildly alkaline; clear irregular boundary.

B2—3 to 12 inches; pale brown (10YR 6/3) channery loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; common very fine pores; 25 percent channery fragments; slightly effervescent; mildly alkaline; gradual smooth boundary.

C1ca—12 to 23 inches; light gray (10YR 7/2) very channery loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots, some forming horizontal root mats on fragments; 50 percent channery fragments; common lime concretions coating fragments; disseminated lime; violently effervescent; strongly alkaline; gradual wavy boundary.

C2ca—23 to 60 inches; white (10YR 8/2) extremely channery loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots, some forming horizontal root mats on fragments; 60 percent channery fragments; many lime concretions coating fragments; disseminated lime; violently effervescent; strongly alkaline.

The A and B horizons are 20 to 35 percent rock fragments, of which 0 to 20 percent is fragments larger than 3 inches in diameter. The fine earth fraction in the A and B horizons is loam or clay loam. The C horizon is moderately alkaline or strongly alkaline. Depth to the Cca horizon ranges from 7 to 18 inches. The Cca horizon is 35 to 70 percent rock fragments, of which 0 to 30 percent is fragments larger than 3 inches in diameter.

Woodhall Series

The Woodhall series consists of moderately deep, well drained soils on upland hills and ridges. These soils formed in material derived from igneous bedrock. Slope is 4 to 25 percent. Elevation is 6,000 to 8,000 feet. The average annual precipitation is 15 to 19 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is 60 to 90 days.

These soils are loamy-skeletal, mixed Argic Cryoborolls.

Typical pedon of a Woodhall stony loam in an area of Woodhall-Blaine-Hapgood complex, 4 to 25 percent slopes, in an area of rangeland, 2,600 feet north and 1,500 feet west of the southeast corner of sec. 6, T. 6 S., R. 2 W.

A1—0 to 10 inches; very dark gray (10YR 3/1) stony loam, black (10YR 2/1) moist; moderate fine and very fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine vesicular pores; 20 percent pebbles and 5 percent stones; slightly acid; clear irregular boundary.

B2t—10 to 22 inches; brown (10YR 5/3) very stony clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak fine subangular blocky; hard, friable, sticky and plastic; common fine and very fine roots; common very fine vesicular and tubular pores; 30 percent pebbles and 15 percent stones; slightly acid; clear wavy boundary.

B3—22 to 30 inches; pale brown (10YR 6/3) very stony loam, dark brown (10YR 4/3) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine horizontal roots; many very fine pores and few medium interstitial pores; 30 percent pebbles and 20 percent stones; slightly acid; clear wavy boundary.

R—30 inches; basalt that has widely spaced fractures.

Depth to bedrock is 20 to 40 inches. Reaction is slightly acid or neutral. The A horizon is 5 to 30 percent

rock fragments, mainly pebbles or stones. The B2t horizon is 10 to 20 inches thick. It is 20 to 35 percent clay and is 35 to 60 percent pebbles and stones.

Worock Series

The Worock series consists of deep, well drained soils on moraines, terraces, and mountainsides. These soils formed in glacial till, colluvium, and alluvium derived from mixed sources. Slope is 4 to 70 percent. Elevation is 6,000 to 7,500 feet. The average annual precipitation is 20 to 35 inches, the average annual air temperature is 36 to 40 degrees F, and the frost-free period is less than 90 days.

These soils are loamy-skeletal, mixed Typic Cryoboralfs.

Typical pedon of a Worock very stony loam in an area of Worock-Mikesell complex, 15 to 45 percent slopes, in an area of coniferous woodland, 1,000 feet north and 450 feet east of the southwest corner of sec. 6, T. 6 S., R. 2 E.

O1—2 inches to 1 inch; fresh and partially decomposed twigs and needles; abrupt smooth boundary.

O2—1 inch to 0; decomposed forest litter; abrupt smooth boundary.

A1—0 to 6 inches; pale brown (10YR 6/3) very stony loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; common very fine and fine pores; 15 percent stones and cobbles and 35 percent pebbles; medium acid; abrupt wavy boundary.

A2—6 to 18 inches; very pale brown (10YR 7/3) very stony loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many very fine and fine roots and common medium and coarse roots; common very fine and fine pores; 15 percent stones and cobbles and 35 percent pebbles; medium acid; clear wavy boundary.

B21t—18 to 36 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; strong fine and medium subangular blocky structure; very hard, very firm, sticky and plastic; common very fine and fine roots and few medium and coarse roots; common fine and medium pores; many thick brown (7.5YR 5/4) clay films on faces of peds and lining pores; 5 percent stones and cobbles and 35 percent pebbles; slightly acid; clear wavy boundary.

B22t—36 to 52 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; strong fine angular blocky structure; very hard, very firm, sticky and plastic; few very fine, fine, and coarse roots; common medium and coarse pores; common moderately thick dark brown (7.5YR 4/2) clay films on faces of peds and lining pores; 5 percent stones and cobbles and 35 percent pebbles; slightly acid; abrupt smooth boundary.

C1ca—52 to 60 inches; very pale brown (10YR 7/4) very gravelly clay loam, pale brown (10YR 6/3) moist; massive; hard, firm, sticky and plastic; few very fine, fine, and coarse roots; 5 percent stones and cobbles and 35 percent pebbles; violently effervescent; mildly alkaline.

The A horizon is 10 to 20 inches thick. The fine earth fraction of the A horizon is loam or sandy loam. The A horizon is 20 to 50 percent rock fragments. It is strongly acid to slightly acid. The B2t horizon is 35 to 60 percent rock fragments, of which 5 to 30 percent is fragments larger than 3 inches in diameter. It is strongly acid to slightly acid. The fine earth fraction is sandy clay loam or clay loam. The C horizon is strongly acid to mildly alkaline. In some pedons lime is at a depth of more than 60 inches.

Yetull Series

The Yetull series consists of deep, somewhat excessively drained soils on fans, foot slopes, and terraces. These soils formed in alluvium derived from gneiss, schist, and granite. Slope is 2 to 8 percent. Elevation is 4,500 to 6,500 feet. The average annual precipitation is 10 to 14 inches, the average annual air temperature is 38 to 42 degrees F, and the frost-free period is 90 to 105 days.

These soils are mixed, frigid Ustic Torripsamments.

Typical pedon of Yetull loamy sand, cool, 2 to 8 percent slopes, in an area of rangeland, 1,500 feet south and 900 feet west of the northeast corner of sec. 35, T. 4 S., R. 1 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine and very fine roots; 5 percent pebbles; mildly alkaline; clear smooth boundary.

C1—8 to 60 inches; light brownish gray (10YR 6/2) loamy coarse sand, dark grayish brown (10YR 4/2) moist; single grain; loose; common fine and very fine roots; 15 percent pebbles; slightly effervescent; moderately alkaline.

The A horizon is 0 to 10 percent rock fragments, mainly pebbles. The C horizon is 0 to 15 percent rock fragments, mainly pebbles, but as much as 5 percent is fragments larger than 3 inches in diameter. The C horizon is loamy coarse sand or coarse sand.

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Glossary

Acid soil. A soil having a pH value of less than 6.6. See Reaction, soil.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkaline soil. A soil having a pH value of more than 7.3. See Reaction, soil.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal-unit-month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3.75
Low	3.75 to 5.0
Moderate	5.0 to 7.5
High	more than 7.5

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition of woody vegetation to allow understory grasses and forbs to recover, or to make conditions favorable for reseeding. It increases production of forage, which reduces erosion. Brush management may improve the habitat for some species of wildlife.

Cable yarding (cable harvesting). A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium

carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Channery soil material. A material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. Very channery soil material is 35 to 60 percent fragments. A single piece is called a channery fragment.

Chemical treatment. Control of unwanted vegetation by use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter, in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay skin. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay film.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

CMAI (culmination of mean annual increment). The point in time during the life of a stand of trees at which the average annual yield is the greatest.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Codominant trees. Trees that have crowns forming the general level of the forest canopy and receiving full light from above but comparatively little from the sides.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. If soil improving crops and practices used in the system more than offset the soil depleting crops and deteriorating practices, then it is a good conservation cropping system. Cropping systems are needed on all tilled soils. Soil improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to

stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops using a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming with the dip of underlying bedded rock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Dominant trees. Trees with crowns forming the general level of the forest canopy and receiving full light from above and on the side.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and low water holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and low water holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have intermediate water holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless artificial drainage is provided. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless artificial drainage is provided. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. They are wet enough to prevent the growth of important crops (except rice) unless artificially drained.

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley, generally more open and with broader bottom land than a ravine or gulch.

Duff. A term used to identify a generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). —Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). —Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, fire that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and produced by erosion or faulting. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, and clay.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone,

slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (or 300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard rock. Rock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A1 or Ap horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

A2 horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected

by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil

passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

MAI (mean annual increment) The average annual increase in the volume of a tree during its entire lifetime.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mesa. A broad, nearly flat topped and commonly isolated upland mass characterized by summit widths that are more than the heights of bounding erosional scarps.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common*, and *many*; size—*fine, medium*, and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color in hue of 10YR, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Pebble. A rounded or angular fragment of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. A collection of pebbles is gravel.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile.

Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed. (See climax plant community.)

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This increases the vigor and reproduction of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity, in pH, is expressed as—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regeneration The new growth of a natural plant community that develops from seed.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Scribner rule. A method of estimating the number of board feet of lumber that can be cut from a log of a given diameter and length.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Selection silvicultural system. A method of harvesting trees that involves the removal of mature and immature trees, whether singly or in groups, at intervals. Regeneration is established almost continuously, and an uneven-aged stand is maintained.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shelterwood silvicultural system. A method of harvesting trees that involves removing the stand in a series of cuts. Regeneration occurs under a partial forest canopy. After regeneration is established, a final harvest cut removes the shelterwood and permits the stand to develop in the open as an even-aged stand.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Silvicultural harvesting system. A method of harvesting trees that provides for the regeneration of desirable tree species, develops a desirable stand structure, and aids in insect and disease control. The application of a silvicultural harvesting system is determined by the kinds of trees a given soil supports, management objectives, and condition of the stands.

Site class. A grouping of site indexes into 5 to 7 production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a

graph that show the average height of dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 4 percent
Moderately sloping	4 to 8 percent
Strongly sloping	8 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 45 percent
Very steep	45 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are—

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soft rock. Rock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows (in millimeters):

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Tail water. The water just downstream of a structure.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep, rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Windthrow. The action of uprooting and tipping over trees by the wind.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
Recorded in the period 1956-78 at Alder, Montana											
January----	32.1	11.1	21.7	51	-26	0	0.31	0.11	0.47	1	5.5
February---	37.7	16.0	26.9	55	-15	9	.21	.03	.35	1	4.5
March------	41.8	18.4	30.1	62	-13	17	.52	.17	.79	2	8.4
April------	50.8	26.3	38.6	72	8	80	.94	.39	1.40	3	7.3
May--------	62.0	33.8	47.9	81	17	260	1.94	1.22	2.58	6	4.1
June-------	71.1	40.7	55.9	88	26	477	2.61	1.49	3.59	7	.2
July-------	81.3	44.8	63.1	92	31	716	1.48	.70	2.15	4	.0
August-----	79.5	43.8	61.7	91	28	673	1.36	.68	1.95	4	.0
September--	68.5	36.0	52.3	87	16	381	1.55	.60	2.37	4	.7
October----	58.3	28.7	43.6	78	7	161	.97	.49	1.40	3	.9
November---	42.2	19.4	30.8	63	-12	11	.62	.28	.91	2	7.4
December---	34.0	13.9	24.0	55	-23	14	.38	.15	.57	1	5.8
Yearly:											
Average--	54.9	27.7	41.4	---	---	---	---	---	---	---	---
Extreme--	---	---	---	93	-32	---	---	---	---	---	---
Total----	---	---	---	---	---	2,799	12.89	10.75	14.98	38	44.8
Recorded in the period 1951-78 at Ennis, Montana											
January----	32.9	13.9	23.4	52	-26	18	0.34	0.09	0.53	1	4.3
February---	38.4	18.1	28.2	58	-18	28	.31	.11	.47	1	4.3
March------	43.2	20.5	31.9	66	-12	39	.61	.26	.90	2	5.1
April------	54.1	28.5	41.3	75	8	125	1.00	.47	1.44	4	3.0
May--------	64.9	36.2	50.6	85	21	332	1.83	1.20	2.40	6	1.0
June-------	73.4	43.0	58.2	90	30	546	2.35	1.34	3.24	7	.0
July-------	82.9	47.3	65.1	94	35	778	1.18	.46	1.77	4	.0
August-----	81.2	45.5	63.3	93	32	722	1.19	.47	1.78	4	.0
September--	70.3	38.0	54.2	89	23	426	1.32	.43	2.03	4	.4
October----	59.8	31.4	45.6	80	10	204	.88	.36	1.33	3	2.1
November---	43.7	23.1	33.4	66	-7	42	.52	.17	.81	2	4.7
December---	35.1	17.0	26.0	55	-20	15	.41	.15	.62	2	5.1
Yearly:											
Average--	56.7	30.2	43.4	---	---	---	---	---	---	---	---
Extreme--	---	---	---	95	-29	---	---	---	---	---	---
Total----	---	---	---	---	---	3,275	11.94	9.39	14.32	40	30.0

See footnote at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average daily	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days*	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
Recorded in the period 1955-78 at Twin Bridges, Montana											
January----	33.4	10.2	21.8	54	-26	14	0.26	0.06	0.41	1	3.7
February---	40.5	14.8	27.7	60	-17	28	.22	.03	.36	1	4.5
March------	45.7	18.7	32.2	68	-10	36	.47	.17	.71	2	3.5
April------	55.7	26.9	41.3	79	10	110	.79	.35	1.15	3	3.3
May--------	66.8	35.0	50.9	87	19	341	1.53	.87	2.11	5	.2
June-------	74.9	41.9	58.4	91	28	552	1.91	.77	2.86	6	.0
July-------	84.4	45.2	64.9	95	33	772	.91	.33	1.40	3	.0
August-----	81.7	42.5	62.1	95	28	685	.96	.37	1.44	4	.0
September--	71.7	34.7	53.2	90	18	396	.91	.21	1.46	2	.0
October----	60.8	27.3	44.1	82	8	157	.51	.14	.80	2	.7
November---	44.7	19.1	31.9	66	-7	12	.38	.08	.61	1	1.7
December---	35.9	12.8	24.4	57	-20	8	.31	.09	.48	1	1.3
Yearly:											
Average--	58.0	27.4	42.7	---	---	---	---	---	---	---	---
Extreme--	---	---	---	95	-29	---	---	---	---	---	---
Total----	---	---	---	---	---	3,111	9.16	7.21	10.99	31	18.9
Recorded in the period 1951-78 at Virginia City, Montana											
January----	32.6	11.3	22.0	51	-26	11	0.74	0.36	1.06	3	9.2
February---	37.8	15.7	26.8	57	-15	19	.49	.16	.75	2	7.3
March------	41.6	17.9	29.7	63	-10	21	.99	.38	1.49	4	11.2
April------	51.9	27.0	39.5	73	8	95	1.42	.81	1.96	5	9.2
May--------	62.0	35.8	48.9	82	18	287	2.38	1.56	3.11	7	4.4
June-------	71.0	42.6	56.9	89	27	507	2.87	1.63	3.96	8	.5
July-------	81.2	49.2	65.3	94	34	784	1.67	.70	2.49	5	.0
August-----	79.3	47.3	63.3	92	31	722	1.45	.57	2.18	5	.0
September--	68.8	38.5	53.6	87	21	417	1.53	.63	2.28	4	1.0
October----	58.5	30.6	44.6	79	9	187	1.13	.39	1.74	4	2.6
November---	42.5	20.5	31.6	63	-7	23	.90	.34	1.35	3	7.2
December---	34.7	13.8	24.3	54	-18	13	.69	.26	1.05	3	12.4
Yearly:											
Average--	55.2	29.2	42.2	---	---	---	---	---	---	---	---
Extreme--	---	---	---	94	-27	---	---	---	---	---	---
Total----	---	---	---	---	---	3,086	16.26	13.56	18.84	53	65.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature 24° F or lower	28° F or lower	32° F or lower
Recorded in the period 1956-78 at Alder, Montana			
Last freezing temperature in spring:			
1 year in 10 later than--	May 31	June 25	July 5
2 years in 10 later than--	May 25	June 16	June 30
5 years in 10 later than--	May 13	May 31	June 20
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 1	Aug. 4	July 4
2 years in 10 earlier than--	Sept. 7	Aug. 13	July 17
5 years in 10 earlier than--	Sept. 19	Aug. 31	Aug. 11
Recorded in the period 1951-78 at Ennis, Montana			
Last freezing temperature in spring:			
1 year in 10 later than--	May 19	June 3	June 20
2 years in 10 later than--	May 13	May 28	June 14
5 years in 10 later than--	May 4	May 17	June 3
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 19	Sept. 4	Aug. 15
2 years in 10 earlier than--	Sept. 25	Sept. 9	Aug. 22
5 years in 10 earlier than--	Oct. 7	Sept. 19	Sept. 5

TABLE 2.--FREEZE DATES IN SPRING AND FALL--Continued

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Recorded in the period 1955-78 at Twin Bridges, Montana			
Last freezing temperature in spring:			
1 year in 10 later than--	June 1	June 14	June 25
2 years in 10 later than--	May 25	June 8	June 20
5 years in 10 later than--	May 12	May 29	June 9
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 5	Aug. 27	July 25
2 years in 10 earlier than--	Sept. 10	Sept. 1	Aug. 4
5 years in 10 earlier than--	Sept. 20	Sept. 11	Aug. 25
Recorded in the period 1951-78 at Virginia City, Montana			
Last freezing temperature in spring:			
1 year in 10 later than--	May 24	June 17	June 30
2 years in 10 later than--	May 17	June 9	June 23
5 years in 10 later than--	May 5	May 24	June 11
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 11	Aug. 21	July 28
2 years in 10 earlier than--	Sept. 18	Aug. 29	Aug. 8
5 years in 10 earlier than--	Oct. 1	Sept. 15	Aug. 28

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
Recorded in the period 1956-78 at Alder, Montana			
9 years in 10	101	49	6
8 years in 10	110	63	21
5 years in 10	128	91	51
2 years in 10	146	119	81
1 year in 10	155	133	96
Recorded in the period 1951-78 at Ennis, Montana			
9 years in 10	131	102	65
8 years in 10	140	110	75
5 years in 10	156	124	93
2 years in 10	172	138	111
1 year in 10	180	146	120
Recorded in the period 1955-78 at Twin Bridges, Montana			
9 years in 10	105	80	40
8 years in 10	114	89	52
5 years in 10	130	105	76
2 years in 10	147	121	100
1 year in 10	155	130	113
Recorded in the period 1951-78 at Virginia City, Montana			
9 years in 10	120	78	40
8 years in 10	130	90	53
5 years in 10	148	113	77
2 years in 10	166	135	102
1 year in 10	176	147	114

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Adel loam, 0 to 4 percent slopes	955	0.1
2	Adel loam, 4 to 15 percent slopes	3,365	0.2
3	Amesha loam, cool, 2 to 8 percent slopes	3,090	0.2
4	Amesha loam, cool, bedrock substratum, 8 to 25 percent slopes	8,160	0.5
5	Amesha, bedrock substratum-Musselshell complex, cool, 2 to 8 percent slopes	3,160	0.2
6	Amsterdam silty clay loam, 2 to 8 percent slopes	800	0.1
7	Amsterdam-Brocko Variant complex, 8 to 15 percent slopes	195	*
8	Aquic Cryoboralfs-Typic Cryochrepts complex, 4 to 15 percent slopes	2,275	0.1
9	Armitage-Thess, cool, complex, 0 to 4 percent slopes	3,535	0.2
10	Attewan loam, cool, 0 to 2 percent slopes	3,700	0.2
11	Attewan loam, cool, 2 to 8 percent slopes	4,270	0.3
12	Attewan cobbly loam, cool, 2 to 8 percent slopes	18,400	1.2
13	Attewan very stony loam, cool, 2 to 8 percent slopes	3,585	0.2
14	Badland	245	*
15	Bearmouth gravelly loam, 2 to 8 percent slopes	3,420	0.2
16	Bearmouth extremely stony loam, 0 to 4 percent slopes	3,695	0.2
17	Beaverell cobbly loam, cool, 0 to 6 percent slopes	17,280	1.1
18	Blackhall-Rock outcrop complex, 15 to 45 percent slopes	13,670	0.9
19	Blaine stony loam, 2 to 15 percent slopes	5,050	0.3
20	Borohemists, nearly level	1,170	0.1
21	Branham coarse sandy loam, 2 to 8 percent slopes	2,440	0.2
22	Branham-Rock outcrop complex, 8 to 45 percent slopes	9,795	0.6
23	Bridger clay loam, 2 to 8 percent slopes	1,365	0.1
24	Bridger cobbly clay loam, 8 to 35 percent slopes	8,380	0.5
25	Bridger-Cryaquolls complex, 2 to 25 percent slopes	1,285	0.1
26	Bridger-Tiban-Adel complex, 8 to 25 percent slopes	3,450	0.2
27	Brocko silt loam, cool, 0 to 2 percent slopes	1,260	0.1
28	Brocko silt loam, cool, 2 to 12 percent slopes	24,780	1.6
29	Brocko-Crago complex, cool, 8 to 45 percent slopes	16,590	1.1
30	Brocko Variant silt loam, 2 to 12 percent slopes	1,980	0.1
31	Bullrey loam, bedrock substratum, 2 to 12 percent slopes	2,045	0.1
32	Comad-Earcree complex, 8 to 45 percent slopes	3,125	0.2
33	Crago gravelly loam, cool, 0 to 8 percent slopes	30,395	2.0
34	Crago gravelly loam, cool, rolling	2,905	0.2
35	Crago very stony loam, cool, 2 to 45 percent slopes	16,120	1.0
36	Crago, cool-Kalsted-Pensore complex, 8 to 45 percent slopes	1,945	0.1
37	Crago-Scravo complex, cool, 15 to 45 percent slopes	24,755	1.6
38	Cryaquolls, nearly level	7,310	0.5
39	Cryoborolls, strongly sloping	1,845	0.1
40	Cryorthents, steep	310	*
41	Earcree sandy loam, 2 to 8 percent slopes	540	*
42	Earcree gravelly sandy loam, dry, 2 to 8 percent slopes	805	0.1
43	Earcree gravelly sandy loam, slightly wet, 8 to 35 percent slopes	2,240	0.1
44	Earcree, dry-Branham-Rock outcrop complex, 35 to 60 percent slopes	3,925	0.3
45	Fluvaquentic Haplaquolls, nearly level	8,935	0.6
46	Garlet very channery sandy loam, cool, 15 to 45 percent slopes	5,845	0.4
47	Garlet, cool-Rock outcrop complex, 45 to 70 percent slopes	8,200	0.5
48	Gaylord-Burnette complex, 4 to 15 percent slopes	3,220	0.2
49	Hanson channery loam, 2 to 8 percent slopes	4,985	0.3
50	Hanson channery loam, 8 to 45 percent slopes	28,800	1.9
51	Hanson-Adel complex, 4 to 45 percent slopes	3,090	0.2
52	Hanson-Raynesford complex, 8 to 35 percent slopes	2,845	0.2
53	Hanson-Rock outcrop complex, 25 to 45 percent slopes	15,520	1.0
54	Hapgood loam, moist, 2 to 8 percent slopes	960	0.1
55	Hapgood loam, moist, 8 to 25 percent slopes	1,160	0.1
56	Hapgood very stony loam, 4 to 15 percent slopes	2,450	0.2
57	Hapgood-Sebud very stony loams, 15 to 45 percent slopes	2,980	0.2
58	Havre loam, cool, 0 to 2 percent slopes	5,695	0.4
59	Havre loam, cool, wet, 0 to 2 percent slopes	3,550	0.2
60	Kalsted loamy sand, 2 to 8 percent slopes	4,740	0.3
61	Kalsted sandy loam, 0 to 2 percent slopes	3,600	0.2
62	Kalsted sandy loam, 2 to 8 percent slopes	48,545	3.1

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
63	Kalsted sandy loam, 8 to 15 percent slopes	6,440	0.4
64	Kalsted gravelly sandy loam, 15 to 35 percent slopes	13,940	0.9
65	Larry Variant peat, 0 to 2 percent slopes	870	0.1
66	Leavitt loam, moist, 2 to 15 percent slopes	2,580	0.2
67	Leavitt cobbly loam, 2 to 8 percent slopes	10,415	0.7
68	Leavitt stony loam, 2 to 25 percent slopes	8,355	0.5
69	Leavitt, moist-Adel complex, 4 to 15 percent slopes	870	0.1
70	Libeg-Adel complex, 4 to 25 percent slopes	6,080	0.4
71	Libeg-Hapgood complex, 15 to 45 percent slopes	6,240	0.4
72	Loberg very stony loam, 15 to 45 percent slopes	975	0.1
73	MacFarlane stony sandy loam, 15 to 45 percent slopes	16,225	1.0
74	MacFarlane very stony sandy loam, warm, 15 to 45 percent slopes	1,825	0.1
75	Marias silty clay loam, cool, 2 to 8 percent slopes	335	*
76	Maxville gravelly loam, 2 to 8 percent slopes	7,410	0.5
77	Maxville cobbly loam, dry, 2 to 8 percent slopes	2,045	0.1
78	Maxville, dry-Bearmouth complex, 0 to 8 percent slopes	2,200	0.1
79	Maxville-Bearmouth complex, rarely flooded, 0 to 4 percent slopes	1,190	0.1
80	Mikesell clay loam, 15 to 45 percent slopes	11,260	0.7
81	Mikesell clay loam, 45 to 60 percent slopes	5,120	0.3
82	Musselshell loam, cool, 2 to 8 percent slopes	33,070	2.1
83	Musselshell gravelly loam, cool, 0 to 2 percent slopes	2,450	0.2
84	Musselshell-Amesha, bedrock substratum, complex, cool, 8 to 25 percent slopes	34,070	2.2
85	Musselshell-Crago complex, cool, 2 to 8 percent slopes	27,095	1.7
86	Neen silty clay loam, 0 to 2 percent slopes	11,780	0.8
87	Neen silty clay loam, drained, 0 to 2 percent slopes	1,490	0.1
88	Neen silty clay loam, wet, 0 to 2 percent slopes	5,175	0.3
89	Nuley sandy loam, 2 to 12 percent slopes	2,825	0.2
90	Nuley clay loam, 2 to 8 percent slopes	9,605	0.6
91	Nuley-Rock outcrop complex, 8 to 35 percent slopes	52,245	3.4
92	Oro Fino loam, 2 to 12 percent slopes	8,170	0.5
93	Oro Fino-Poin complex, 4 to 15 percent slopes	21,735	1.4
94	Oro Fino-Poin complex, 15 to 45 percent slopes	107,455	6.9
95	Pensore-Crago, cool-Rock outcrop complex, 25 to 75 percent slopes	32,900	2.1
96	Pits, gravel	190	*
97	Poin-Earcree, dry, complex, 45 to 60 percent slopes	2,235	0.1
98	Poin-Rock outcrop complex, 4 to 15 percent slopes	640	*
99	Poin-Sebud complex, 8 to 45 percent slopes	7,070	0.5
100	Raynesford loam, 2 to 8 percent slopes	305	*
101	Redchief Variant-Hapgood, moist, complex, 8 to 25 percent slopes	1,670	0.1
102	Rentsac very channery loam, 45 to 75 percent slopes	2,575	0.2
103	Rentsac-Kalsted complex, 8 to 25 percent slopes	5,565	0.4
104	Rentsac-Varney complex, 8 to 45 percent slopes	16,320	1.0
105	Rivra very gravelly sandy loam, cool, 2 to 4 percent slopes	5,510	0.4
106	Rivra, cool-Fluvaquents complex, 0 to 2 percent slopes	22,985	1.5
107	Rivra-Ryell-Havre complex, cool, 0 to 2 percent slopes	17,690	1.1
108	Rochester-Rock outcrop complex, 35 to 70 percent slopes	23,625	1.5
109	Rock outcrop-Cryoborolls-Cryochrepts complex, very steep	18,565	1.2
110	Ryell-Rivra complex, cool, 0 to 2 percent slopes	6,820	0.4
111	Ryell-Rivra sandy loams, cool, saline, 0 to 2 percent slopes	800	0.1
112	Saunders silty clay loam, 0 to 2 percent slopes	3,090	0.2
113	Saunders silty clay loam, reclaimed, 0 to 2 percent slopes	1,200	0.1
114	Scravo sandy loam, cool, 2 to 8 percent slopes	13,190	0.8
115	Scravo very cobbly sandy loam, cool, 0 to 4 percent slopes	16,370	1.1
116	Scravo-Crago complex, cool, 2 to 8 percent slopes	4,570	0.3
117	Scravo-Thess complex, cool, 0 to 4 percent slopes	7,580	0.5
118	Sebud-Hapgood complex, 8 to 45 percent slopes	23,980	1.5
119	Sebud-Hapgood-Rock outcrop complex, 25 to 60 percent slopes	58,950	3.8
120	Sebud-Rochester-Rock outcrop complex, 25 to 60 percent slopes	1,445	0.1
121	Shadow very channery loam, 15 to 45 percent slopes	8,415	0.5
122	Shadow very flaggy loam, 45 to 70 percent slopes	6,780	0.4
123	Shadow complex, warm, 15 to 45 percent slopes	14,355	0.9
124	Shadow complex, warm, 45 to 70 percent slopes	27,490	1.8

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
125	Shadow, warm-Mikesell-Worock complex, 45 to 70 percent slopes	830	0.1
126	Shedhorn clay loam, 8 to 25 percent slopes	1,430	0.1
127	Shedhorn, cool-Garlet, cool-Rock outcrop complex, 30 to 70 percent slopes	5,780	0.4
128	Shedhorn-Rock outcrop complex, 15 to 45 percent slopes	4,865	0.3
129	Shurley-Rentsac-Rock outcrop complex, 8 to 35 percent slopes	32,840	2.1
130	Shurley-Rock outcrop complex, 25 to 60 percent slopes	40,990	2.6
131	Thess sandy loam, cool, 2 to 4 percent slopes	3,805	0.2
132	Thess loam, cool, 2 to 8 percent slopes	7,305	0.5
133	Thess-Amesha loams, cool, 0 to 2 percent slopes	5,870	0.4
134	Tiban cobbly loam, 2 to 15 percent slopes	4,405	0.3
135	Tiban very stony loam, 15 to 45 percent slopes	14,765	0.9
136	Tiban, moist-Rock outcrop complex, 8 to 45 percent slopes	685	*
137	Tineman gravelly loam, 2 to 8 percent slopes	1,610	0.1
138	Tineman-Earcree complex, 4 to 25 percent slopes	350	*
139	Trimad cobbly loam, 2 to 8 percent slopes	7,785	0.5
140	Trimad cobbly loam, 15 to 45 percent slopes	23,585	1.5
141	Trimad very stony loam, 2 to 8 percent slopes	5,415	0.3
142	Trimad-Kalsted complex, 8 to 45 percent slopes	17,345	1.1
143	Trudau loam, 2 to 8 percent slopes	6,585	0.4
144	Trudau loam, slightly saline, 2 to 8 percent slopes	7,185	0.5
145	Ustic Torriorthents, gently sloping	330	*
146	Ustic Torriorthents, hilly	1,290	0.1
147	Varney clay loam, 2 to 8 percent slopes	36,655	2.4
148	Varney clay loam, 8 to 15 percent slopes	7,435	0.5
149	Varney cobbly clay loam, 8 to 45 percent slopes	19,250	1.2
150	Villy silty clay loam, cool, 0 to 2 percent slopes	3,880	0.2
151	Villy silty clay loam, cool, drained, 0 to 2 percent slopes	2,105	0.1
152	Whitecow-Rock outcrop complex, 25 to 70 percent slopes	14,635	0.9
153	Whitore complex, 15 to 45 percent slopes	11,925	0.8
154	Whitore-Mikesell, warm-Rock outcrop complex, 25 to 60 percent slopes	2,105	0.1
155	Whitore-Rock outcrop complex, 25 to 70 percent slopes	26,770	1.7
156	Woodhall gravelly loam, 4 to 15 percent slopes	5,570	0.4
157	Woodhall-Blaine-Hapgood complex, 4 to 25 percent slopes	10,935	0.7
158	Worock gravelly sandy loam, 8 to 35 percent slopes	675	*
159	Worock-Mikesell complex, 15 to 45 percent slopes	15,995	1.0
160	Yetull loamy sand, cool, 2 to 8 percent slopes	3,370	0.2
	Water	1,375	0.1
	Total	1,556,880	100.0

* Less than 0.05 percent. The map units assigned an asterisk make up 0.3 percent of the county.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Winter wheat		Spring wheat		Barley		Alfalfa hay		Grass-legume hay		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Tons	Tons	AUM*	AUM*
1 Adel	---	---	---	---	---	---	---	4.0	---	3.0	3.0	---
2 Adel	---	---	---	---	---	---	---	---	---	3.0	3.0	---
3 Amesha	30	70	25	75	40	80	---	5.0	---	3.8	1.5	7.0
5 Amesha-Musselshell	---	---	---	---	---	---	---	---	---	---	1.5	---
6 Amsterdam	45	80	40	85	60	90	---	5.5	---	4.0	2.0	8.0
7 Amsterdam-Brocko Variant	37	67	32	72	47	82	---	---	---	3.7	1.6	7.0
9 Armitage-Thess	---	70	---	70	---	80	---	5.0	---	3.5	1.2	6.5
10, 11, 12 Attewan	30	70	25	70	40	80	---	5.0	---	3.5	1.5	7.0
17 Beaverell	---	---	---	55	---	65	---	3.8	---	2.5	0.8	5.0
21 Branham	---	---	---	---	---	---	---	3.0	---	---	2.0	6.0
27 Brocko	40	75	35	80	55	90	---	5.5	---	4.0	2.0	8.0
28 Brocko	35	70	30	75	50	80	---	5.0	---	3.8	1.8	7.5
30 Brocko Variant	35	70	30	75	50	80	---	5.0	---	3.8	1.8	7.5
31 Bullrey	---	---	---	---	---	---	---	---	---	3.0	2.0	6.0
33 Crago	---	55	---	60	---	70	---	4.5	---	3.2	1.0	6.5
42 Earcree	---	---	---	---	---	---	---	4.5	---	3.0	---	6.5
48 Gaylord-Burnette	---	---	---	---	---	---	---	4.5	---	3.0	3.0	---
58 Havre	---	70	---	75	---	80	---	5.0	---	3.8	---	7.5
59 Havre	---	---	---	70	---	75	---	---	---	3.2	---	7.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat		Spring wheat		Barley		Alfalfa hay		Grass-legume hay		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Tons	Tons	AUM*	AUM*
60------------------------ Kalsted	---	60	---	65	---	75	---	4.8	---	3.5	1.0	6.5
61, 62-------------------- Kalsted	25	70	20	75	35	80	---	5.0	---	3.5	1.5	7.0
63------------------------ Kalsted	20	60	15	65	30	75	---	---	---	3.2	1.2	6.5
65------------------------ Larry Variant	---	---	---	---	---	---	---	---	3.5	---	---	---
67------------------------ Leavitt	---	---	---	---	---	---	---	4.5	---	3.0	2.5	7.0
75------------------------ Marias	35	70	30	75	50	80	---	5.0	---	3.8	1.8	7.5
76, 77-------------------- Maxville	---	---	---	---	---	---	---	4.5	---	3.0	2.5	7.0
82, 83-------------------- Musselshell	25	65	20	70	35	80	---	5.0	---	3.5	1.5	7.0
85------------------------ Musselshell-Crago	---	60	---	66	---	76	---	4.8	---	3.4	1.3	6.8
87------------------------ Neen	---	---	---	70	---	80	---	4.0	---	3.8	---	7.0
89------------------------ Nuley	---	---	---	---	---	---	---	---	---	---	1.2	---
90------------------------ Nuley	30	70	25	70	40	80	---	5.0	---	3.5	1.5	7.0
92------------------------ Oro Fino	---	---	---	---	---	---	---	4.5	---	3.0	2.5	7.0
107----------------------- Rivra-Ryell-Havre	---	---	---	---	---	---	---	---	---	2.1	---	4.3
110----------------------- Ryell-Rivra	---	---	---	---	---	---	---	---	---	2.9	---	5.8
113----------------------- Saunders	---	---	---	---	---	80	---	4.0	---	3.8	---	7.5
114----------------------- Scravo	---	---	---	40	---	60	---	4.0	---	3.0	---	5.5
117----------------------- Scravo-Thess	---	---	---	---	---	---	---	3.7	---	2.8	---	4.9
131----------------------- Thess	20	70	15	70	30	80	---	5.0	---	3.5	1.0	6.5
132----------------------- Thess	25	70	20	70	35	80	---	5.0	---	3.5	1.2	6.5

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Winter wheat		Spring wheat		Barley		Alfalfa hay		Grass-legume hay		Pasture	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons	Tons	Tons	AUM*	AUM*
133 Thess-Amesha	27	70	22	72	37	80	---	5.0	---	3.6	1.3	6.7
139 Trimad	---	---	---	---	---	---	---	4.5	---	3.2	1.2	6.0
144 Trudau	---	---	---	60	---	70	---	4.0	---	3.0	---	5.5
147 Varney	35	70	30	75	50	80	---	5.0	---	3.8	1.8	7.5
148 Varney	30	60	25	65	40	75	---	---	---	3.2	1.2	6.5
151 Villy	---	---	---	70	---	80	---	---	---	3.8	---	7.5
160 Yetull	---	---	---	---	---	---	---	4.5	---	3.2	1.0	6.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Woodland management interpretations are listed in this table for forested soils in the survey area)

Soil name and map symbol	Ordi- nation symbol	Management concerns: Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Potential productivity: Common trees	Site index	Trees to plant
32*:								
Comad----------	4X	Moderate	Severe	Slight	Severe	Douglas-fir--------- Lodgepole pine------	41 68	Lodgepole pine, Douglas-fir.
Earcree.								
43-------------- Earcree	2A	Slight	Slight	Slight	Moderate	Quaking aspen-------	47	
46-------------- Garlet	3R	Moderate	Moderate	Moderate	Moderate	Engelmann spruce---- Whitebark pine------ Subalpine fir------- Lodgepole pine------	50 34 --- ---	Engelmann spruce.
47*:								
Garlet---------	3R	Severe	Moderate	Moderate	Moderate	Engelmann spruce---- Whitebark pine------ Subalpine fir------- Lodgepole pine------	50 34 --- ---	Engelmann spruce.
Rock outcrop.								
72-------------- Loberg	5R	Severe	Slight	Moderate	Slight	Lodgepole pine------ Douglas-fir--------- Engelmann spruce---- Subalpine fir-------	63 54 49 ---	Douglas-fir, lodgepole pine, Engelmann spruce.
73-------------- MacFarlane	5R	Moderate	Slight	Moderate	Moderate	Lodgepole pine------ Douglas-fir--------- Subalpine fir------- Engelmann spruce----	64 57 --- 77	Douglas-fir, Engelmann spruce, lodgepole pine.
74-------------- MacFarlane	4R	Moderate	Moderate	Moderate	Moderate	Douglas-fir--------- Lodgepole pine------	42 65	Lodgepole pine, Douglas-fir.
80, 81---------- Mikesell	6R	Severe	Slight	Moderate	Moderate	Lodgepole pine------ Engelmann spruce---- Douglas-fir--------- Subalpine fir-------	67 84 52 ---	Engelmann spruce, Douglas-fir, lodgepole pine.
108*:								
Rochester------	3R	Severe	Severe	Slight	Severe	Douglas-fir--------- Lodgepole pine------	38 ---	Douglas-fir.
Rock outcrop.								
120*:								
Sebud.								
Rochester------	3R	Severe	Severe	Slight	Severe	Douglas-fir--------- Lodgepole pine------	38 ---	Douglas-fir.
Rock outcrop.								

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Trees to plant
121, 122-------- Shadow	4R	Moderate	Slight	Moderate	Severe	Lodgepole pine------ Engelmann spruce---- Subalpine fir-------	66 71 	Engelmann spruce, lodgepole pine.
123*:								
Shadow very channery sandy loam----------	4R	Moderate	Moderate	Slight	Severe	Douglas-fir--------- Lodgepole pine------ Engelmann spruce----	46 62 82	Engelmann spruce, Douglas-fir.
Shadow stony loam----------	4R	Moderate	Moderate	Slight	Severe	Douglas-fir--------- Lodgepole pine------ Engelmann spruce----	46 62 82	Engelmann spruce, Douglas-fir.
124*:								
Shadow very channery sandy loam----------	4R	Severe	Moderate	Slight	Severe	Douglas-fir--------- Lodgepole pine------ Engelmann spruce----	46 62 82	Engelmann spruce, Douglas-fir.
Shadow stony loam----------	4R	Severe	Moderate	Slight	Severe	Douglas-fir--------- Lodgepole pine------ Engelmann spruce----	46 62 82	Engelmann spruce, Douglas-fir.
125*:								
Shadow---------	4R	Severe	Moderate	Slight	Severe	Douglas-fir--------- Lodgepole pine------ Engelmann spruce----	46 62 82	Engelmann spruce, Douglas-fir.
Mikesell-------	6R	Severe	Slight	Moderate	Moderate	Lodgepole pine------ Engelmann spruce---- Douglas-fir--------- Subalpine fir-------	67 84 52 ---	Engelmann spruce, Douglas-fir, lodgepole pine.
Worock---------	5R	Severe	Slight	Moderate	Moderate	Lodgepole pine------ Douglas-fir--------- Subalpine fir------- Engelmann spruce----	64 57 --- 77	Douglas-fir, Engelmann spruce, lodgepole pine.
127*:								
Shedhorn.								
Garlet---------	3R	Severe	Moderate	Moderate	Moderate	Engelmann spruce---- Whitebark pine------ Subalpine fir------- Lodgepole pine------	50 34 --- ---	Engelmann spruce, lodgepole pine.
Rock outcrop.								
152*:								
Whitecow-------	2R	Severe	Severe	Slight	Severe	Douglas-fir---------	22	Douglas-fir.
Rock outcrop.								

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
153*:								
Whitore channery loam	3R	Moderate	Slight	Slight	Moderate	Douglas-fir	37	Douglas-fir.
Whitore stony loam	3R	Moderate	Slight	Slight	Moderate	Douglas-fir	37	Douglas-fir.
154*:								
Whitore	3R	Severe	Slight	Slight	Moderate	Douglas-fir	37	Douglas-fir.
Mikesell	4R	Severe	Slight	Moderate	Moderate	Douglas-fir Lodgepole pine	40 57	Douglas-fir, lodgepole pine.
Rock outcrop.								
155*:								
Whitore channery loam	3R	Severe	Slight	Slight	Moderate	Douglas-fir	37	Douglas-fir.
Whitore stony loam	3R	Severe	Slight	Slight	Moderate	Douglas-fir	37	Douglas-fir.
Rock outcrop.								
158 Worock	5R	Slight	Slight	Moderate	Moderate	Lodgepole pine Douglas-fir Subalpine fir Engelmann spruce	64 57 --- 77	Douglas-fir, Engelmann spruce, lodgepole pine.
159*:								
Worock	5R	Moderate	Slight	Moderate	Moderate	Lodgepole pine Douglas-fir Subalpine fir Engelmann spruce	64 57 --- 77	Douglas-fir, lodgepole pine, Engelmann spruce.
Mikesell	6R	Severe	Slight	Moderate	Moderate	Lodgepole pine Engelmann spruce Douglas-fir Subalpine fir	67 84 52 ---	Engelmann spruce, Douglas-fir, lodgepole pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1 Adel	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
2 Adel	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
3 Amesha	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.	Slight.
4 Amesha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
5*:					
Amesha	Moderate: dusty.	Moderate: dusty.	Moderate: slope.	Severe: erodes easily.	Slight.
Musselshell	Moderate: dusty.	Moderate: dusty.	Severe: small stones.	Moderate: dusty.	Moderate: large stones.
6 Amsterdam	Slight	Slight	Moderate: slope.	Slight	Slight.
7*:					
Amsterdam	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Brocko Variant	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
8*:					
Aquic Cryoboralfs.					
Typic Cryochrepts.					
9*:					
Armitage	Severe: excess sodium.	Severe: excess sodium.	Severe: large stones, excess sodium.	Moderate: large stones.	Severe: large stones, excess sodium.
Thess	Moderate: dusty.	Moderate: dusty.	Moderate: slope.	Severe: erodes easily.	Severe: droughty.
10 Attewan	Moderate: dusty.	Moderate: dusty.	Moderate: small stones.	Severe: erodes easily.	Moderate: droughty.
11 Attewan	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: droughty.
12 Attewan	Moderate: large stones, small stones, dusty.	Moderate: large stones, small stones, dusty.	Severe: large stones, small stones.	Moderate: dusty.	Moderate: small stones, large stones, droughty.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
13 Attewan	Moderate: large stones, small stones, dusty.	Moderate: large stones, small stones, dusty.	Severe: large stones, small stones.	Moderate: large stones, dusty.	Severe: large stones.
14*. Badland					
15 Bearmouth	Slight	Slight	Severe: small stones.	Slight	Severe: droughty.
16 Bearmouth	Severe: large stones.	Severe: large stones.	Severe: large stones, small stones.	Severe: large stones.	Severe: large stones, droughty.
17 Beaverell	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: large stones, small stones.	Moderate: large stones, dusty.	Severe: droughty.
18*: Blackhall	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop.					
19 Blaine	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: large stones.	Moderate: large stones, droughty, slope.
20. Borohemists					
21 Branham	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight	Severe: droughty.
22*: Branham	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Rock outcrop.					
23 Bridger	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
24 Bridger	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.
25*: Bridger	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
25*: Cryaquolls.					
26*: Bridger	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.	Severe: slope.
Tiban	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.	Severe: slope.
Adel	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
27 Brocko	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
28 Brocko	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.	Slight.
29*: Brocko	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Crago	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
30 Brocko Variant	Slight	Slight	Severe: slope.	Severe: erodes easily.	Slight.
31 Bullrey	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
32*: Comad	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: droughty, slope.
Earcree	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
33 Crago	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: small stones.	Moderate: dusty.	Moderate: small stones, large stones.
34 Crago	Moderate: slope, small stones, dusty.	Moderate: slope, small stones, dusty.	Severe: slope, small stones.	Moderate: dusty.	Moderate: small stones, slope.
35 Crago	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: large stones, slope, dusty.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
36*:					
Crago	Severe: slope.	Severe: slope.	Severe: large stones,	Severe: slope.	Severe: slope.
Kalsted	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
Pensore	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones.	Severe: small stones, slope, droughty.
37*:					
Crago	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Scravo	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.	Severe: droughty, slope.
38. Cryaquolls					
39. Cryoborolls					
40. Cryorthents					
41 Earcree	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
42 Earcree	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, large stones.
43 Earcree	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
44*:					
Earcree	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Branham	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Rock outcrop.					
45. Fluvaquentic Haplaquolls					

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
46------------------- Garlet	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
47*:					
Garlet---------------	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Rock outcrop.					
48*:					
Gaylord--------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Burnette-------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
49------------------- Hanson	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Moderate: small stones, droughty.
50------------------- Hanson	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
51*:					
Hanson---------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Adel-----------------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
52*:					
Hanson---------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
Raynesford-----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
53*:					
Hanson---------------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Rock outcrop.					
54------------------- Hapgood	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
55------------------- Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
56------------------- Hapgood	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: large stones, slope, small stones.	Severe: large stones.	Severe: large stones.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
57*:					
Hapgood	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: large stones, slope.	Severe: large stones, slope.
Sebud	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: large stones, slope.
58 Havre	Severe: flooding.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
59 Havre	Severe: flooding.	Moderate: dusty.	Moderate: flooding, dusty.	Severe: erodes easily.	Moderate: flooding.
60 Kalsted	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
61 Kalsted	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
62 Kalsted	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
63 Kalsted	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
64 Kalsted	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
65 Larry Variant	Severe: flooding, wetness, excess humus.	Severe: wetness, excess humus.	Severe: excess humus, wetness.	Severe: wetness, excess humus.	Severe: wetness, excess humus.
66 Leavitt	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
67 Leavitt	Moderate: large stones.	Moderate: large stones.	Moderate: slope, small stones.	Slight	Moderate: large stones.
68 Leavitt	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
69*:					
Leavitt	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones.
Adel	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
70*:					
Libeg	Severe: small stones.	Severe: small stones.	Severe: large stones, slope, small stones.	Severe: large stones.	Severe: large stones.
Adel	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones, slope.
71*:					
Libeg	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: large stones, slope.	Severe: large stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: large stones, slope.	Severe: slope.
72 Loberg	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, slope.
73 MacFarlane	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, large stones.
74 MacFarlane	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones.
75 Marias	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
76 Maxville	Slight	Slight	Severe: small stones.	Slight	Moderate: small stones, large stones.
77 Maxville	Moderate: large stones.	Moderate: large stones.	Severe: small stones.	Slight	Moderate: small stones, large stones.
78*:					
Maxville	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Bearmouth	Severe: large stones.	Severe: large stones.	Severe: large stones, small stones.	Severe: large stones.	Severe: large stones, droughty.
79*:					
Maxville	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight	Slight.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
79*:					
Bearmouth	Severe: flooding, large stones.	Severe: large stones.	Moderate: large stones, slope, small stones.	Severe: large stones.	Severe: large stones, droughty.
80, 81 Mikesell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
82 Musselshell	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Severe: erodes easily.	Moderate: large stones.
83 Musselshell	Moderate: dusty.	Moderate: dusty.	Severe: small stones.	Moderate: dusty.	Moderate: large stones.
84*:					
Musselshell	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, dusty.	Severe: slope.
Amesha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
85*:					
Musselshell	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Severe: erodes easily.	Moderate: large stones.
Crago	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: small stones.	Moderate: dusty.	Moderate: small stones, large stones.
86 Neen	Severe: flooding, excess salt.	Severe: excess salt.	Severe: excess salt.	Severe: erodes easily.	Severe: excess salt.
87 Neen	Severe: flooding.	Slight	Slight	Slight	Slight.
88 Neen	Severe: flooding, wetness, excess salt.	Severe: wetness, excess salt.	Severe: wetness, excess salt.	Severe: wetness, erodes easily.	Severe: excess salt, wetness.
89 Nuley	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
90 Nuley	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
91*:					
Nuley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Rock outcrop.					

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
92 Oro Fino	Slight	Slight	Severe: slope.	Slight	Slight.
93*: Oro Fino	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
Poin	Severe: large stones, small stones, depth to rock.	Severe: large stones, small stones, depth to rock.	Severe: large stones, slope, small stones.	Moderate: large stones.	Severe: small stones, large stones, droughty.
94*: Oro Fino	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Poin	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, droughty.
95*: Pensore	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones.	Severe: small stones, slope, droughty.
Crago	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
96*. Pits					
97*: Poin	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, droughty.
Earcree	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
98*: Poin	Severe: large stones, small stones, depth to rock.	Severe: large stones, small stones, depth to rock.	Severe: large stones, slope, small stones.	Moderate: large stones.	Severe: small stones, large stones, droughty.
Rock outcrop.					
99*: Poin	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, droughty.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
99*:					
Sebud	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
100 Raynesford	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
101*:					
Redchief Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
102 Rentsac	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: small stones, slope, droughty.
103*:					
Rentsac	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, droughty.
Kalsted	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
104*:					
Rentsac	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, droughty.
Varney	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
105 Rivra	Severe: flooding, small stones, wetness.	Severe: wetness, small stones.	Severe: small stones, wetness.	Severe: wetness.	Severe: small stones, wetness, droughty.
106*:					
Rivra	Severe: flooding, wetness.	Severe: wetness.	Severe: small stones, wetness.	Severe: wetness.	Severe: wetness, droughty.
Fluvaquents.					
107*:					
Rivra	Severe: flooding.	Slight	Severe: small stones.	Slight	Severe: droughty.
Ryell	Severe: flooding.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and* map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
107*:					
Havre	Severe: flooding.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
108*:					
Rochester	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, droughty.
Rock outcrop.					
109*:					
Rock outcrop.					
Cryoborolls.					
Cryochrepts.					
110*:					
Ryell	Severe: flooding.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
Rivra	Severe: flooding, wetness.	Severe: wetness.	Severe: small stones, wetness.	Severe: wetness.	Severe: wetness, droughty.
111*:					
Ryell	Severe: flooding, wetness.	Moderate: wetness, excess salt.	Severe: wetness.	Moderate: wetness.	Moderate: excess salt, wetness, droughty.
Rivra	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
112 Saunders	Severe: flooding, wetness, excess salt.	Severe: excess salt.	Severe: wetness, excess salt.	Moderate: wetness.	Severe: excess salt.
113 Saunders	Severe: flooding.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
114 Scravo	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
115 Scravo	Severe: large stones.	Severe: large stones.	Severe: large stones, small stones.	Moderate: large stones.	Severe: large stones, droughty.
116*:					
Scravo	Severe: large stones.	Severe: large stones.	Severe: large stones, small stones.	Moderate: large stones.	Severe: large stones, droughty.
Crago	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Severe: erodes easily.	Moderate: droughty.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
117*:					
Scravo	Moderate: large stones.	Moderate: large stones.	Severe: large stones.	Slight	Severe: droughty.
Thess	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.	Severe: droughty.
118*:					
Sebud	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: large stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
119*:					
Sebud	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: large stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Rock outcrop.					
120*:					
Sebud	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Rochester	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, droughty.
Rock outcrop.					
121 Shadow	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, droughty.
122 Shadow	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, droughty.
123*, 124*:					
Shadow very channery sandy loam	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, droughty.
Shadow stony loam	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, large stones, droughty.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
125*:					
Shadow	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
Mikesell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Worock	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
126 Shedhorn	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
127*:					
Shedhorn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Garlet	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope.	Severe: slope.	Severe: small stones, large stones.
Rock outcrop.					
128*:					
Shedhorn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
129*:					
Shurley	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.	Severe: small stones, large stones, droughty.
Rentsac	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, droughty.
Rock outcrop.					
130*:					
Shurley	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, large stones, droughty.
Rock outcrop.					
131 Thess	Slight	Slight	Moderate: slope, small stones.	Slight	Severe: droughty.
132 Thess	Moderate: dusty.	Moderate: dusty.	Moderate: slope.	Severe: erodes easily.	Severe: droughty.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
133*:					
Thess	Moderate: dusty.	Moderate: dusty.	Slight	Severe: erodes easily.	Severe: droughty.
Amesha	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
134 Tiban	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: large stones, slope, small stones.	Moderate: large stones.	Moderate: small stones, large stones.
135 Tiban	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: large stones, slope.
136*:					
Tiban	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: large stones, slope.
Rock outcrop.					
137 Tineman	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones, large stones.
138*:					
Tineman	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: large stones, slope, small stones.	Moderate: large stones.	Moderate: small stones, large stones, slope.
Earcree	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
139 Trimad	Moderate: large stones, small stones.	Moderate: large stones, small stones.	Severe: large stones, small stones.	Moderate: large stones, dusty.	Moderate: small stones, large stones.
140 Trimad	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.
141 Trimad	Moderate: large stones, small stones.	Moderate: large stones, small stones.	Severe: large stones, small stones.	Moderate: large stones, dusty.	Severe: large stones.
142*:					
Trimad	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.
Kalsted	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
143------------------- Trudau	Severe: excess salt.	Severe: excess salt.	Severe: excess salt.	Severe: erodes easily.	Poor: excess salt.
144------------------- Trudau	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.	Slight.
145, 146. Ustic Torriorthents					
147------------------- Varney	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
148------------------- Varney	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
149------------------- Varney	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.
150------------------- Villy	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
151------------------- Villy	Severe: flooding.	Moderate: percs slowly.	Moderate: percs slowly.	Slight----------	Slight.
152*:					
Whitecow-------------	Severe: slope, large stones, small stones.	Severe: slope, large stones, small stones.	Severe: large stones, slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
Rock outcrop.					
153*:					
Whitore channery loam	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Whitore stony loam---	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
154*:					
Whitore--------------	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Mikesell-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Rock outcrop.					
155*:					
Whitore channery loam	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
155*:					
Whitore stony loam	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Rock outcrop.					
156 Woodhall	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
157*:					
Woodhall	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, large stones.
Blaine	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: large stones.	Moderate: large stones, droughty, slope.
Hapgood	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
158 Worock	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
159*:					
Worock	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: small stones, slope.
Mikesell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
160 Yetull	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1 Adel	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
2 Adel	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
3 Amesha	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
4 Amesha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
5*:						
Amesha	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Musselshell	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
6 Amsterdam	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
7*:						
Amsterdam	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Brocko Variant	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
8*:						
Aquic Cryoboralfs.						
Typic Cryochrepts.						
9*:						
Armitage	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Severe: large stones, excess sodium.
Thess	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Severe: droughty.
10 Attewan	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
11 Attewan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
12----------------- Attewan	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: small stones, large stones, droughty.
13----------------- Attewan	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Severe: large stones.
14*. Badland						
15----------------- Bearmouth	Severe: cutbanks cave, large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: droughty.
16----------------- Bearmouth	Severe: cutbanks cave, large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones, droughty.
17----------------- Beaverell	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: frost action, large stones.	Severe: droughty.
18*:						
Blackhall---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop.						
19----------------- Blaine	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Moderate: large stones, droughty, slope.
20. Borohemists						
21----------------- Branham	Severe: depth to rock, cutbanks cave.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock, frost action.	Severe: droughty.
22*:						
Branham----------	Severe: depth to rock, cutbanks cave, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Rock outcrop.						
23----------------- Bridger	Moderate: too clayey.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: large stones.
24----------------- Bridger	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
25*:						
Bridger	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Cryaquolls.						
26*:						
Bridger	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Tiban	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Adel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
27 Brocko	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
28 Brocko	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
29*:						
Brocko	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Crago	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
30 Brocko Variant	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
31 Bullrey	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
32*:						
Comad	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: droughty, slope.
Earcree	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
33 Crago	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: small stones, large stones.
34 Crago	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
35 Crago	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
36*:						
Crago	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalsted	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pensore	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, droughty.
37*:						
Crago	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Scravo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
38. Cryaquolls						
39. Cryoborolls						
40. Cryorthents						
41 Earcree	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
42 Earcree	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: small stones, large stones.
43 Earcree	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44*:						
Earcree	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Branham	Severe: depth to rock, cutbanks cave, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Rock outcrop.						

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
45. Fluvaquentic Haplaquolls						
46 Garlet	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, slope.
47*:						
Garlet	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, slope.
Rock outcrop.						
48*:						
Gaylord	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
Burnette	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
49 Hanson	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: small stones, droughty.
50 Hanson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
51*:						
Hanson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Adel	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
52*:						
Hanson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Raynesford	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
53*:						
Hanson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
54 Hapgood	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
55 Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
56 Hapgood	Moderate: large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, frost action, large stones.	Severe: large stones.
57*:						
Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
Sebud	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.
58 Havre	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
59 Havre	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
60 Kalsted	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
61 Kalsted	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
62 Kalsted	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
63 Kalsted	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
64 Kalsted	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65 Larry Variant	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, frost action.	Severe: wetness, excess humus.
66 Leavitt	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
67 Leavitt	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Moderate: large stones.
68 Leavitt	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: large stones, slope.
69*:						
Leavitt	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: small stones, large stones, slope.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
69*:						
Adel	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
70*:						
Libeg	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.	Severe: large stones.
Adel	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, large stones, slope.
71*:						
Libeg	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
72 Loberg	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.
73, 74 MacFarlane	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.
75 Marias	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
76, 77 Maxville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: small stones, large stones.
78*:						
Maxville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Bearmouth	Severe: cutbanks cave, large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones, droughty.
79*:						
Maxville	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
Bearmouth	Severe: cutbanks cave, large stones.	Severe: flooding, large stones.	Severe: flooding, large stones.	Severe: flooding, large stones.	Severe: large stones.	Severe: large stones, droughty.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
80, 81 Mikesell	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
82 Musselshell	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
83 Musselshell	Slight	Slight	Slight	Slight	Moderate: frost action.	Moderate: large stones.
84*:						
Musselshell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Amesha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
85*:						
Musselshell	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
Crago	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: small stones, large stones.
86 Neen	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, frost action.	Severe: excess salt.
87 Neen	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
88 Neen	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: excess salt, wetness.
89, 90 Nuley	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
91*:						
Nuley	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
92 Oro Fino	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
93*:						
Oro Fino	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, slope.
Poin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: small stones, large stones, droughty.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
94*:						
Oro Fino	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Poin	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, large stones, droughty.
95*:						
Pensore	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, droughty.
Crago	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
96*. Pits						
97*:						
Poin	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, large stones, droughty.
Earcree	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
98*:						
Poin	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: small stones, large stones, droughty.
Rock outcrop.						
99*:						
Poin	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, large stones, droughty.
Sebud	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, slope.
100 Raynesford	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
101*:						
Redchief Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
101*:						
Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
102 Rentsac	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, droughty.
103*:						
Rentsac	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, droughty.
Kalsted	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
104*:						
Rentsac	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, droughty.
Varney	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
105 Rivra	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: small stones, wetness, droughty.
106*:						
Rivra	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, droughty.
Fluvaquents.						
107*:						
Rivra	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: droughty.
Ryell	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
Havre	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
108*:						
Rochester	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, large stones, droughty.
Rock outcrop.						
109*:						
Rock outcrop.						

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
109*:						
Cryoborolls.						
Cryochrepts.						
110*:						
Ryell	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
Rivra	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, droughty.
111*:						
Ryell	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: frost action.	Moderate: excess salt, wetness, droughty.
Rivra	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, frost action.	Severe: wetness.
112 Saunders	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Severe: excess salt.
113 Saunders	Moderate: too clayey, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
114 Scravo	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
115 Scravo	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Severe: large stones, droughty.
116*:						
Scravo	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: large stones.	Severe: large stones, droughty.
Crago	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
117*:						
Scravo	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Thess	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Severe: droughty.
118*:						
Sebud	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
119*:						
Sebud-----------	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.
Hapgood----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
120*:						
Sebud-----------	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, slope.
Rochester--------	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, large stones, droughty.
Rock outcrop.						
121--------------- Shadow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
122--------------- Shadow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, droughty.
123*, 124*:						
Shadow very channery sandy loam------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, droughty, slope.
Shadow stony loam	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, droughty.
125*:						
Shadow-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Mikesell---------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Worock-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
126--------------- Shedhorn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
127*:						
Shedhorn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Garlet	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, large stones, slope.
Rock outcrop.						
128*:						
Shedhorn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Rock outcrop.						
129*:						
Shurley	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, large stones, droughty.
Rentsac	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, droughty.
Rock outcrop.						
130*:						
Shurley	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: small stones, large stones, droughty.
Rock outcrop.						
131 Thess	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Severe: droughty.
132 Thess	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Severe: droughty.
133*:						
Thess	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Severe: droughty.
Amesha	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
134 Tiban	Moderate: large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, frost action, large stones.	Moderate: small stones, large stones, slope.
135 Tiban	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
136*:						
Tiban	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: large stones, slope.
Rock outcrop.						
137 Tineman	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: small stones, large stones.
138*:						
Tineman	Severe: cutbanks cave.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, frost action, large stones.	Moderate: small stones, large stones, slope.
Earcree	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
139 Trimad	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: small stones, large stones.
140 Trimad	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
141 Trimad	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Severe: large stones.
142*:						
Trimad	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kalsted	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
143 Trudau	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: low strength, frost action, shrink-swell.	Poor: excess salt.
144 Trudau	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: low strength, frost action, shrink-swell.	Slight.
145, 146. Ustic Torriorthents						
147 Varney	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
148 Varney	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
149 Varney	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
150 Villy	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
151 Villy	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: frost action.	Slight.
152*:						
Whitecow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Rock outcrop.						
153*:						
Whitore channery loam	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Whitore stony loam	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
154*:						
Whitore	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Mikesell	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Rock outcrop.						
155*:						
Whitore channery loam	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Whitore stony loam	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.						
156 Woodhall	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Moderate: small stones, slope.
157*:						
Woodhall	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Moderate: small stones, large stones, slope.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
157*						
Blaine	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Moderate: large stones, droughty, slope.
Hapgood	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, slope.
158 Worock	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
159*:						
Worock	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Mikesell	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
160 Yetull	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1------------------- Adel	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
2------------------- Adel	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
3------------------- Amesha	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
4------------------- Amesha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
5*:					
Amesha-------------	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Fair: area reclaim, thin layer.
Musselshell---------	Moderate: percs slowly.	Severe: seepage.	Slight-----------	Slight-----------	Poor: small stones.
6------------------- Amsterdam	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
7*:					
Amsterdam----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Brocko Variant-----	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
8*:					
Aquic Cryoboralfs.					
Typic Cryochrepts.					
9*:					
Armitage-----------	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----------	Poor: seepage, too sandy, small stones.
Thess--------------	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----------	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10, 11, 12, 13------ Attewan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
14*. Badland					
15, 16------------- Bearmouth	Severe: poor filter, large stones.	Severe: seepage, large stones.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
17----------------- Beaverell	Severe: poor filter.	Severe: seepage, large stones.	Severe: seepage, too sandy, large stones.	Severe: seepage.	Poor: seepage, too sandy, small stones.
18*:					
Blackhall----------	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: area reclaim, slope.
Rock outcrop.					
19----------------- Blaine	Severe: depth to rock.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, small stones.
20. Borohemists					
21----------------- Branham	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
22*:					
Branham------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, slope.
Rock outcrop.					
23----------------- Bridger	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Poor: small stones.
24----------------- Bridger	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
25*:					
Bridger------------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Cryaquolls.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
26*:					
Bridger	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Tiban	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Adel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
27 Brocko	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
28 Brocko	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
29*:					
Brocko	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Crago	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: seepage, small stones, slope.
30 Brocko Variant	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
31 Bullrey	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, small stones, slope.
32*:					
Comad	Severe: poor filter, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, large stones.
Earcree	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
33 Crago	Severe: poor filter.	Severe: seepage.	Slight	Slight	Poor: seepage, small stones.
34 Crago	Moderate: percs slowly, slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Poor: seepage, small stones.
35 Crago	Severe: slope.	Severe: seepage, slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
36*:					
Crago	Severe: slope.	Severe: seepage, slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Kalsted	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
Pensore	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
37*:					
Crago	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: seepage, small stones, slope.
Scravo	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: seepage, too sandy, small stones.
38. Cryaquolls					
39. Cryoborolls					
40. Cryorthents					
41, 42 Earcree	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
43 Earcree	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
44*:					
Earcree	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
Branham	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, slope.
Rock outcrop.					
45. Fluvaquentic Haplaquolls					
46 Garlet	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
47*:					
Garlet	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
48*:					
Gaylord	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Burnette	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
49 Hanson	Moderate: percs slowly, large stones.	Moderate: seepage, slope, large stones.	Severe: large stones.	Slight	Poor: small stones.
50 Hanson	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
51*:					
Hanson	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Adel	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
52*:					
Hanson	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Raynesford	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
53*:					
Hanson	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
54 Hapgood	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: small stones.
55 Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
56 Hapgood	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.	Moderate: slope.	Poor: small stones.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
57*:					
Hapgood	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Sebud	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
58 Havre	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
59 Havre	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
60, 61, 62 Kalsted	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy, small stones.
63 Kalsted	Moderate: slope.	Severe: seepage, slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: too sandy, small stones, slope.
64 Kalsted	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
65 Larry Variant	Severe: wetness, poor filter.	Severe: seepage, flooding, excess humus.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, small stones, wetness.
66 Leavitt	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
67 Leavitt	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
68 Leavitt	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
69*:					
Leavitt	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
Adel	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
70*:					
Libeg	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.	Moderate: slope.	Poor: large stones.
Adel	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
71*:					
Libeg	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
72 Loberg	Severe: percs slowly, slope.	Severe: slope, large stones.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, large stones, slope.
73, 74 MacFarlane	Severe: slope.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
75 Marias	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
76, 77 Maxville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
78*:					
Maxville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Bearmouth	Severe: poor filter, large stones.	Severe: seepage, large stones.	Severe: seepage, too sandy, large stones.	Severe: seepage.	Poor: seepage, too sandy, small stones.
79*:					
Maxville	Severe: poor filter.	Severe: seepage, flooding.	Severe: seepage, wetness.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Bearmouth	Severe: poor filter, large stones.	Severe: seepage, flooding.	Severe: seepage, too sandy, large stones.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
80, 81 Mikesell	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
82, 83 Musselshell	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Poor: small stones.
84*:					
Musselshell	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Amesha	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
85*:					
Musselshell	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Poor: small stones.
Crago	Severe: poor filter.	Severe: seepage.	Slight	Slight	Poor: seepage, small stones.
86 Neen	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
87 Neen	Severe: percs slowly.	Severe: flooding.	Severe: wetness.	Moderate: flooding, wetness.	Good.
88 Neen	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
89 Nuley	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy, small stones.
90 Nuley	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, too sandy, small stones.
91*:					
Nuley	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Rock outcrop.					
92 Oro Fino	Moderate: percs slowly.	Severe: seepage, slope.	Severe: seepage.	Slight	Poor: small stones.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
93*:					
Oro Fino	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: small stones.
Poin	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, seepage, small stones.
94*:					
Oro Fino	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: small stones, slope.
Poin	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, seepage, small stones.
95*:					
Pensore	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Crago	Severe: slope.	Severe: seepage, slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
96*. Pits					
97*:					
Poin	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, seepage, small stones.
Earcree	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
98*:					
Poin	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim, seepage, small stones.
Rock outcrop.					
99*:					
Poin	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, seepage, small stones.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
99*:					
Sebud	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
100 Raynesford	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey, large stones.	Slight	Poor: small stones.
101*:					
Redchief Variant	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, small stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
102 Rentsac	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
103*:					
Rentsac	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Kalsted	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
104*:					
Rentsac	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Varney	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
105 Rivra	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
106*:					
Rivra	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding.	Severe: flooding, wetness, too sandy.	Severe: flooding, wetness.	Poor: seepage, too sandy, small stones.
Fluvaquents.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
107*:					
Rivra	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy, small stones.
Ryell	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy, small stones.
Havre	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
108*:					
Rochester	Severe: poor filter, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Rock outcrop.					
109*:					
Rock outcrop.					
Cryoborolls.					
Cryochrepts.					
110*:					
Ryell	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Moderate: flooding.	Poor: seepage, too sandy, small stones.
Rivra	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
111*:					
Ryell	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, small stones.
Rivra	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, small stones, wetness.
112 Saunders	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
113 Saunders	Severe: wetness, percs slowly.	Severe: flooding, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
114, 115 Scravo	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy, small stones.
116*:					
Scravo	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy, small stones.
Crago	Severe: poor filter.	Severe: seepage.	Slight	Slight	Poor: seepage, small stones.
117*:					
Scravo	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy, small stones.
Thess	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy, small stones.
118*:					
Sebud	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
119*:					
Sebud	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Hapgood	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
120*:					
Sebud	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Rochester	Severe: poor filter, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
121, 122------------ Shadow	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
123*, 124*:					
Shadow very channery sandy loam--------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Shadow stony loam--	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
125*:					
Shadow-------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, small stones, slope.
Mikesell-----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
Worock-------------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
126----------------- Shedhorn	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, small stones, slope.
127*:					
Shedhorn-----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, small stones, slope.
Garlet-------------	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
128*:					
Shedhorn-----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, small stones, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
129*:					
Shurley	Severe: poor filter, slope, large stones.	Severe: seepage, slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: seepage, small stones, slope.
Rentsac	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					
130*:					
Shurley	Severe: poor filter, slope, large stones.	Severe: seepage, slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: seepage, small stones, slope.
Rock outcrop.					
131, 132 Thess	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy, small stones.
133*:					
Thess	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy, small stones.
Amesha	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
134 Tiban	Moderate: percs slowly, slope, large stones.	Severe: slope.	Moderate: slope, too clayey, large stones.	Moderate: slope.	Poor: small stones.
135 Tiban	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
136*:					
Tiban	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
137 Tineman	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
138*:					
Tineman	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
138*:					
Earcree	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
139 Trimad	Moderate: large stones.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
140 Trimad	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
141 Trimad	Moderate: large stones.	Severe: seepage, large stones.	Severe: seepage.	Severe: seepage.	Poor: small stones.
142*:					
Trimad	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
Kalsted	Moderate: slope.	Severe: seepage, slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: too sandy, small stones, slope.
143, 144 Trudau	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
145, 146. Ustic Torriorthents					
147 Varney	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Poor: small stones.
148 Varney	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.
149 Varney	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
150 Villy	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
151 Villy	Severe: percs slowly.	Moderate: seepage, wetness.	Severe: wetness.	Moderate: flooding, wetness.	Fair: too clayey.
152*:					
Whitecow	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
153*:					
Whitore channery loam	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Whitore stony loam	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
154*:					
Whitore	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Mikesell	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
Rock outcrop.					
155*:					
Whitore channery loam	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Whitore stony loam	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
156 Woodhall	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, small stones.
157*:					
Woodhall	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock, small stones.
Blaine	Severe: depth to rock.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, small stones.
Hapgood	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: small stones.
158 Worock	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
159*:					
Worock	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
159*:					
Mikesell	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, small stones.
160 Yetull	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1 Adel	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
2 Adel	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
3 Amesha	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
4 Amesha	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
5*:				
Amesha	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Musselshell	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
6 Amsterdam	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
7*:				
Amsterdam	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Brocko Variant	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
8*:				
Aquic Cryoboralfs.				
Typic Cryochrepts.				
9*:				
Armitage	Good	Probable	Probable	Poor: area reclaim, excess sodium.
Thess	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
10, 11, 12, 13 Attewan	Good	Probable	Probable	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
14*. Badland				
15 Bearmouth	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
16 Bearmouth	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
17 Beaverell	Fair: large stones.	Probable	Probable	Poor: small stones, area reclaim.
18*: Blackhall	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Rock outcrop.				
19 Blaine	Poor: area reclaim.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones.
20. Borohemists				
21 Branham	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
22*: Branham	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Rock outcrop.				
23 Bridger	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
24 Bridger	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
25*: Bridger	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Cryaquolls.				

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
26*:				
Bridger	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Tiban	Fair: large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Adel	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
27, 28 Brocko	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
29*:				
Brocko	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Crago	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
30 Brocko Variant	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
31 Bullrey	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
32*:				
Comad	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: large stones, area reclaim, slope.
Earcree	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
33, 34 Crago	Good	Probable	Probable	Poor: small stones, area reclaim.
35 Crago	Fair: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
36*:				
Crago	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
36*:				
Kalsted	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Pensore	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
37*:				
Crago	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Scravo	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
38. Cryaquolls				
39. Cryoborolls				
40. Cryorthents				
41, 42 Earcree	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
43 Earcree	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
44*:				
Earcree	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Branham	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Rock outcrop.				
45. Fluvaquentic Haplaquolls				
46 Garlet	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
47*:				
Garlet	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
48*:				
Gaylord	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Burnette	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
49 Hanson	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
50 Hanson	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
51*:				
Hanson	Fair: large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Adel	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
52*:				
Hanson	Fair: large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Raynesford	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
53*:				
Hanson	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
54 Hapgood	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
55: Hapgood	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
56: Hapgood	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
57*:				
Hapgood	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Sebud	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
58: Havre	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
59: Havre	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
60, 61, 62: Kalsted	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
63: Kalsted	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
64: Kalsted	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
65: Larry Variant	Poor: wetness.	Probable	Probable	Poor: excess humus, small stones, area reclaim.
66, 67, 68: Leavitt	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
69*:				
Leavitt	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Adel	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
70*:				
Libeg	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
Adel	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
71*:				
Libeg	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Hapgood	Fair: large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
72 Loberg	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
73, 74 MacFarlane	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
75 Marias	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
76, 77 Maxville	Good	Probable	Probable	Poor: small stones, area reclaim.
78*:				
Maxville	Good	Probable	Probable	Poor: small stones, area reclaim.
Bearmouth	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
79*:				
Maxville	Good	Probable	Probable	Poor: small stones, area reclaim.
Bearmouth	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: too sandy, small stones, area reclaim.
80, 81 Mikesell	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
82, 83 Musselshell	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
84*:				
Musselshell	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Amesha	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
85*:				
Musselshell	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Crago	Good	Probable	Probable	Poor: small stones, area reclaim.
86 Neen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
87 Neen	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
88 Neen	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
89, 90 Nuley	Fair: area reclaim, thin layer.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim.
91*:				
Nuley	Fair: area reclaim, thin layer, slope.	Improbable: thin layer.	Improbable: thin layer.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
92 Oro Fino	Good	Probable	Probable	Poor: small stones, area reclaim.
93*:				
Oro Fino	Good	Probable	Probable	Poor: small stones, area reclaim.
Poin	Poor: area reclaim.	Improbable: small stones.	Improbable: thin layer.	Poor: area reclaim, small stones.
94*:				
Oro Fino	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
94*:				
Poin	Poor: area reclaim, slope.	Improbable: small stones.	Improbable: thin layer.	Poor: area reclaim, small stones, slope.
95*:				
Pensore	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Crago	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
96*. Pits				
97*:				
Poin	Poor: area reclaim, slope.	Improbable: small stones.	Improbable: thin layer.	Poor: area reclaim, small stones, slope.
Earcree	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
98*:				
Poin	Poor: area reclaim.	Improbable: small stones.	Improbable: thin layer.	Poor: area reclaim, small stones.
Rock outcrop.				
99*:				
Poin	Poor: area reclaim, slope.	Improbable: small stones.	Improbable: thin layer.	Poor: area reclaim, small stones, slope.
Sebud	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
100 Raynesford	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
101*:				
Redchief Variant	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
101*:				
Hapgood	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
102 Rentsac	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
103*:				
Rentsac	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Kalsted	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
104*:				
Rentsac	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Varney	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
105 Rivra	Poor: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
106*:				
Rivra	Poor: wetness.	Probable	Probable	Poor: small stones, area reclaim, wetness.
Fluvaquents.				
107*:				
Rivra	Fair: large stones.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Ryell	Good	Probable	Probable	Poor: small stones, area reclaim.
Havre	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
108*:				
Rochester	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
109*:				
Rock outcrop.				
Cryoborolls.				
Cryochrepts.				
110*:				
Ryell	Good	Probable	Probable	Poor: small stones, area reclaim.
Rivra	Poor: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
111*:				
Ryell	Fair: wetness.	Probable	Probable	Poor: small stones, area reclaim, excess salt.
Rivra	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones, area reclaim.
112 Saunders	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: excess salt, thin layer.
113 Saunders	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
114 Scravo	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
115 Scravo	Fair: large stones.	Probable	Probable	Poor: small stones, area reclaim.
116*:				
Scravo	Fair: large stones.	Probable	Probable	Poor: small stones, area reclaim.
Crago	Good	Probable	Probable	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
117*:				
Scravo	Good	Probable	Probable	Poor: small stones, area reclaim.
Thess	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
118*:				
Sebud	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Hapgood	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
119*:				
Sebud	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Hapgood	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
120*:				
Sebud	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Rochester	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
121, 122 Shadow	Poor: slope.	Improbable: small stones.	Probable	Poor: small stones, area reclaim, slope.
123*, 124*: Shadow very channery sandy loam	Poor: slope.	Improbable: small stones.	Probable	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
123*, 124*:				
Shadow stony loam	Poor: slope.	Improbable: small stones.	Probable	Poor: small stones, area reclaim, slope.
125*:				
Shadow	Poor: slope.	Improbable: small stones.	Probable	Poor: small stones, area reclaim, slope.
Mikesell	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Worock	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
126 Shedhorn	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
127*:				
Shedhorn	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Garlet	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
128*:				
Shedhorn	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
129*:				
Shurley	Poor: large stones.	Improbable: large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.
Rentsac	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
130*:				
Shurley	Poor: large stones, slope.	Improbable: large stones.	Improbable: large stones.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
131, 132 Thess	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
133*:				
Thess	Good	Improbable: small stones.	Probable	Poor: small stones, area reclaim.
Amesha	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
134 Tiban	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
135 Tiban	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
136*:				
Tiban	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
137 Tineman	Fair: large stones.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
138*:				
Tineman	Fair: large stones.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Earcree	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
139 Trimad	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
140 Trimad	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
141 Trimad	Fair: large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
142*:				
Trimad	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Kalsted	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
143 Trudau	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt.
144 Trudau	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
145, 146. Ustic Torriorthents				
147, 148 Varney	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
149 Varney	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
150 Villy	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
151 Villy	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
152*:				
Whitecow	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
153*:				
Whitore channery loam	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
Whitore stony loam	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
154*:				
Whitore	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
Mikesell	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
155*:				
Whitore channery loam	Poor: slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim, slope.
Whitore stony loam	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
156 Woodhall	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
157*:				
Woodhall	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Blaine	Poor: area reclaim.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones.
Hapgood	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
158 Worock	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
159*:				
Worock	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Mikesell	Poor: low strength, slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
160 Yetull	Good	Probable	Improbable: too sandy.	Fair: too sandy, large stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1----------------- Adel	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
2----------------- Adel	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
3----------------- Amesha	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
4----------------- Amesha	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
5*:						
Amesha-----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
Musselshell------	Severe: seepage.	Severe: seepage.	Deep to water	Slope----------	Favorable------	Favorable.
6----------------- Amsterdam	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
7*:						
Amsterdam--------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Brocko Variant---	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
8*:						
Aquic Cryoboralfs.						
Typic Cryochrepts.						
9*:						
Armitage---------	Severe: seepage.	Severe: seepage, excess sodium.	Deep to water	Percs slowly, excess sodium.	Erodes easily, too sandy.	Excess sodium, erodes easily, percs slowly.
Thess------------	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, erodes easily.	Erodes easily, too sandy.	Erodes easily, droughty.
10---------------- Attewan	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, erodes easily.	Erodes easily, too sandy.	Erodes easily, droughty.
11---------------- Attewan	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope, erodes easily.	Erodes easily, too sandy.	Erodes easily, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
12, 13 Attewan	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Large stones, too sandy.	Large stones, droughty.
14*. Badland						
15 Bearmouth	Severe: seepage.	Severe: seepage, large stones.	Deep to water	Slope, large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
16 Bearmouth	Severe: seepage.	Severe: seepage, large stones.	Deep to water	Large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
17 Beaverell	Severe: seepage.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Large stones, too sandy.	Large stones, droughty.
18*: Blackhall	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Rock outcrop.						
19 Blaine	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
20. Borohemists						
21 Branham	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, depth to rock.	Depth to rock, soil blowing.	Droughty, depth to rock.
22*: Branham	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.	Slope, droughty, depth to rock.
Rock outcrop.						
23 Bridger	Moderate: seepage, slope.	Slight	Deep to water	Slope	Large stones	Favorable.
24 Bridger	Severe: slope.	Moderate: large stones.	Deep to water	Slope	Slope, large stones.	Large stones, slope.
25*: Bridger	Severe: slope.	Moderate: large stones.	Deep to water	Slope	Slope, large stones.	Large stones, slope.
Cryaquolls.						
26*: Bridger	Severe: slope.	Moderate: large stones.	Deep to water	Slope	Slope, large stones.	Large stones, slope.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
26*:						
Tiban	Severe: slope.	Moderate: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Adel	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
27 Brocko	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
28 Brocko	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
29*:						
Brocko	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Crago	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
30 Brocko Variant	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
31 Bullrey	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Slope.
32*:						
Comad	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Earcree	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
33 Crago	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Favorable	Droughty.
34 Crago	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
35 Crago	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
36*:						
Crago	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Kalsted	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
36*:						
Pensore	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
37*:						
Crago	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Scravo	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones, too sandy.	Large stones, slope, droughty.
38. Cryaquolls						
39. Cryoborolls						
40. Cryorthents						
41, 42 Earcree	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
43 Earcree	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
44*:						
Earcree	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Branham	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, depth to rock.	Slope, depth to rock, soil blowing.	Slope, droughty, depth to rock.
Rock outcrop.						
45. Fluvaquentic Haplaquolls						
46 Garlet	Severe: slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
47*:						
Garlet	Severe: slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope, droughty.
Rock outcrop.						
48*:						
Gaylord	Severe: slope.	Slight	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
48*:						
Burnette	Severe: slope.	Slight	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
49 Hanson	Moderate: seepage, slope.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Large stones	Large stones, droughty.
50 Hanson	Severe: slope.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
51*:						
Hanson	Severe: slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Adel	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
52*:						
Hanson	Severe: slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Raynesford	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, large stones.	Large stones, slope.
53*:						
Hanson	Severe: slope.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.						
54 Hapgood	Moderate: seepage, slope.	Moderate: large stones.	Deep to water	Slope	Large stones	Large stones.
55 Hapgood	Severe: slope.	Moderate: large stones.	Deep to water	Slope	Slope, large stones.	Large stones, slope.
56 Hapgood	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
57*:						
Hapgood	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Sebud	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
58 Havre	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
59 Havre	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily, flooding.	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
60 Kalsted	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
61 Kalsted	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
62 Kalsted	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
63, 64 Kalsted	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
65 Larry Variant	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness	Erodes easily, wetness, too sandy.	Wetness, erodes easily.
66 Leavitt	Severe: slope.	Severe: thin layer.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
67 Leavitt	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Large stones	Large stones.
68 Leavitt	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, large stones.	Large stones, slope.
69*:						
Leavitt	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Slope.
Adel	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
70*:						
Libeg	Severe: slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Adel	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
71*:						
Libeg	Severe: slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Hapgood	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
72 Loberg	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, percs slowly.	Large stones, slope, droughty.
73, 74 MacFarlane	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, soil blowing.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
75-------------- Marias	Moderate: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
76, 77----------- Maxville	Severe: seepage.	Severe: seepage.	Deep to water	Slope----------	Large stones, too sandy.	Large stones.
78*:						
Maxville---------	Severe: seepage.	Severe: seepage.	Deep to water	Slope----------	Large stones, too sandy.	Favorable.
Bearmouth--------	Severe: seepage.	Severe: seepage, large stones.	Deep to water	Slope, large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
79*:						
Maxville---------	Severe: seepage.	Severe: seepage.	Deep to water	Favorable------	Large stones, too sandy.	Favorable.
Bearmouth--------	Severe: seepage.	Severe: seepage, large stones.	Deep to water	Large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
80, 81----------- Mikesell	Severe: slope.	Moderate: hard to pack, large stones.	Deep to water	Percs slowly, slope, erodes easily.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
82--------------- Musselshell	Severe: seepage.	Severe: seepage.	Deep to water	Slope, erodes easily.	Favorable------	Favorable.
83--------------- Musselshell	Severe: seepage.	Severe: seepage.	Deep to water	Favorable------	Favorable------	Favorable.
84*:						
Musselshell------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope----------	Slope----------	Slope.
Amesha-----------	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
85*:						
Musselshell------	Severe: seepage.	Severe: seepage.	Deep to water	Slope, erodes easily.	Favorable------	Favorable.
Crago------------	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Favorable------	Droughty.
86--------------- Neen	Slight---------	Moderate: piping, wetness, excess salt.	Frost action, excess salt.	Wetness, erodes easily, excess salt.	Erodes easily, wetness.	Excess salt, erodes easily.
87--------------- Neen	Slight---------	Slight---------	Deep to water	Favorable------	Favorable------	Favorable.
88--------------- Neen	Slight---------	Severe: wetness.	Flooding, frost action, excess salt.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, excess salt, erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
89------- Nuley	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
90------- Nuley	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy------	Droughty.
91*:						
Nuley-------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Rock outcrop.						
92------- Oro Fino	Moderate: seepage, slope.	Severe: seepage.	Deep to water	Slope-------	Favorable------	Favorable.
93*, 94*:						
Oro Fino-------	Severe: slope.	Severe: seepage.	Deep to water	Slope-------	Slope-------	Slope.
Poin-------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
95*:						
Pensore-------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
Crago-------	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.						
96*. Pits						
97*:						
Poin-------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Earcree-------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
98*:						
Poin-------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
99*:						
Poin-------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, depth to rock.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
99*: Sebud	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
100 Raynesford	Moderate: slope.	Severe: piping.	Deep to water	Slope	Large stones	Large stones.
101*: Redchief Variant	Severe: slope.	Slight	Deep to water	Droughty, percs slowly, slope.	Slope, erodes easily, percs slowly.	Slope, erodes easily, droughty.
Hapgood	Severe: slope.	Moderate: large stones.	Deep to water	Slope	Slope, large stones.	Large stones, slope.
102 Rentsac	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
103*: Rentsac	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Kalsted	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
104*: Rentsac	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Varney	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Slope.
105 Rivra	Severe: seepage.	Severe: seepage, wetness.	Large stones, slope, cutbanks cave.	Slope, large stones, wetness.	Large stones, wetness, too sandy.	Large stones, wetness, droughty.
106*: Rivra	Severe: seepage.	Severe: seepage, wetness.	Flooding, large stones.	Large stones, wetness, droughty.	Large stones, wetness, too sandy.	Large stones, wetness, droughty.
Fluvaquents.						
107*: Rivra	Severe: seepage.	Severe: seepage.	Large stones, cutbanks cave.	Large stones	Large stones, too sandy.	Large stones, wetness, droughty.
Ryell	Severe: seepage.	Severe: seepage.	Deep to water	Erodes easily	Erodes easily, too sandy.	Erodes easily.
Havre	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
108*:						
Rochester	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Rock outcrop.						
109*:						
Rock outcrop.						
Cryoborolls.						
Cryochrepts.						
110*:						
Ryell	Severe: seepage.	Severe: seepage.	Deep to water	Erodes easily	Erodes easily, too sandy.	Erodes easily.
Rivra	Severe: seepage.	Severe: seepage, wetness.	Large stones, cutbanks cave.	Large stones, wetness, soil blowing.	Large stones, wetness, too sandy.	Large stones, wetness, droughty.
111*:						
Ryell	Severe: seepage.	Severe: seepage, wetness.	Frost action, cutbanks cave.	Wetness, droughty, soil blowing.	Erodes easily, wetness, too sandy.	Wetness, excess salt.
Rivra	Severe: seepage.	Severe: wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Wetness, droughty.
112 Saunders	Slight	Severe: wetness.	Percs slowly, frost action, excess salt.	Wetness, percs slowly, excess salt.	Erodes easily, wetness, percs slowly.	Wetness, excess salt, erodes easily.
113 Saunders	Slight	Moderate: wetness.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Erodes easily, percs slowly.
114 Scravo	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
115 Scravo	Severe: seepage.	Severe: seepage.	Deep to water	Large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
116*:						
Scravo	Severe: seepage.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Large stones, too sandy.	Large stones, droughty.
Crago	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty, erodes easily.	Erodes easily	Erodes easily, droughty.
117*:						
Scravo	Severe: seepage.	Severe: seepage.	Deep to water	Droughty	Large stones, too sandy.	Large stones, droughty.
Thess	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, erodes easily.	Erodes easily, too sandy.	Erodes easily, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
118*:						
Sebud	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Hapgood	Severe: slope.	Moderate: large stones.	Deep to water	Slope	Slope, large stones.	Large stones, slope.
119*:						
Sebud	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Hapgood	Severe: slope.	Moderate: large stones.	Deep to water	Slope	Slope, large stones.	Large stones, slope.
Rock outcrop.						
120*:						
Sebud	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Rochester	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, fast intake.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Rock outcrop.						
121 Shadow	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope	Slope, droughty.
122 Shadow	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
123*, 124*:						
Shadow very channery sandy loam	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope	Slope, droughty.
Shadow stony loam	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
125*:						
Shadow	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
Mikesell	Severe: slope.	Moderate: hard to pack, large stones.	Deep to water	Percs slowly, slope, erodes easily.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
Worock	Severe: slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
126----------- Shedhorn	Severe: slope.	Slight---------	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
127*:						
Shedhorn---------	Severe: slope.	Slight---------	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Garlet-----------	Severe: slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.						
128*:						
Shedhorn---------	Severe: slope.	Slight---------	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Rock outcrop.						
129*:						
Shurley----------	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Rentsac----------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
130*:						
Shurley----------	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, soil blowing.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Rock outcrop.						
131--------------- Thess	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy------	Droughty.
132--------------- Thess	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope, erodes easily.	Erodes easily, too sandy.	Erodes easily, droughty.
133*:						
Thess------------	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, erodes easily.	Erodes easily, too sandy.	Erodes easily, droughty.
Amesha-----------	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
134, 135---------- Tiban	Severe: slope.	Moderate: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
136*:						
Tiban------------	Severe: slope.	Moderate: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
136*: Rock outcrop.						
137---------------- Tineman	Severe: seepage.	Severe: seepage.	Deep to water	Slope, large stones, droughty.	Large stones, too sandy.	Large stones, droughty.
138*:						
Tineman----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Earcree----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
139---------------- Trimad	Severe: seepage.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Large stones---	Large stones, droughty.
140---------------- Trimad	Severe: seepage, slope.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
141---------------- Trimad	Severe: seepage.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Large stones---	Large stones, droughty.
142*:						
Trimad-----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Kalsted----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
143---------------- Trudau	Moderate: slope.	Severe: piping.	Deep to water	Droughty, slope, erodes easily.	Erodes easily	Erodes easily, droughty, excess salt.
144---------------- Trudau	Moderate: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
145, 146. Ustic Torriorthents						
147---------------- Varney	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
148---------------- Varney	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
149---------------- Varney	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Large stones, slope.
150---------------- Villy	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
151: Villy	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
152*: Whitecow	Severe: slope.	Moderate: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.						
153*: Whitore channery loam	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Whitore stony loam	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
154*: Whitore	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Mikesell	Severe: slope.	Moderate: hard to pack, large stones.	Deep to water	Percs slowly, slope, erodes easily.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
Rock outcrop.						
155*: Whitore channery loam	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Whitore stony loam	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.						
156: Woodhall	Severe: slope.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
157*: Woodhall	Severe: slope.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Blaine	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Hapgood	Severe: slope.	Moderate: large stones.	Deep to water	Slope	Slope, large stones.	Large stones, slope.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
158---------------- Worock	Severe: slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope.
159*:						
Worock-----------	Severe: slope.	Moderate: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope.
Mikesell---------	Severe: slope.	Moderate: hard to pack, large stones.	Deep to water	Percs slowly, slope, erodes easily.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
160---------------- Yetull	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1, 2------------- Adel	0-23	Loam-------------	CL-ML	A-4	0-5	85-100	80-100	65-95	55-85	25-30	5-10
	23-37	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	85-100	80-100	65-95	55-80	25-35	5-15
	37-60	Clay loam, channery loam, gravelly loam.	CL, CL-ML, SM-SC, GM-GC	A-6, A-4	0-10	70-100	60-90	55-85	40-75	25-35	5-15
3---------------- Amesha	0-7	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	70-90	55-75	25-35	5-15
	7-60	Loam, sandy loam, silt loam.	ML, CL-ML	A-4	0-5	95-100	90-100	70-90	55-75	20-30	NP-10
4---------------- Amesha	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	70-90	55-75	25-35	5-15
	8-35	Loam, sandy loam, silt loam.	ML, CL-ML	A-4	0-5	95-100	90-100	70-90	55-75	15-25	NP-10
	35-52	Loam, fine sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0-5	85-100	80-100	65-85	45-65	15-25	NP-10
	52	Weathered bedrock	---	---	---	---	---	---	---	---	---
5*:											
Amesha----------	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	70-90	55-75	25-35	5-15
	8-35	Loam, sandy loam, silt loam.	ML, CL-ML	A-4	0-5	95-100	90-100	70-90	55-75	15-25	NP-10
	35-52	Loam, fine sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0-5	85-100	80-100	65-85	45-65	15-25	NP-10
	52	Weathered bedrock	---	---	---	---	---	---	---	---	---
Musselshell-----	0-8	Gravelly loam----	CL-ML, GM-GC, SM-SC	A-4	5-15	65-85	60-80	45-65	40-60	25-30	5-10
	8-25	Gravelly loam, loam.	CL-ML, GM, GM-GC, ML	A-4	0-15	65-100	60-100	45-80	40-70	15-25	NP-10
	25-60	Very gravelly sandy loam, very gravelly fine sandy loam, very gravelly loam.	GM-GC, GM	A-2, A-1	10-15	40-60	30-55	25-45	10-30	15-25	NP-10
6---------------- Amsterdam	0-5	Silty clay loam	CL	A-6	0	100	100	95-100	85-100	30-40	10-15
	5-11	Silt loam, very fine sandy loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	11-34	Silt loam, very fine sandy loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	34-60	Silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	100	95-100	70-90	20-30	NP-10
7*:											
Amsterdam-------	0-5	Silty clay loam	CL	A-6	0	100	100	95-100	85-100	30-40	10-15
	5-11	Silt loam, very fine sandy loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	11-34	Silt loam, very fine sandy loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-95	25-40	5-15
	34-60	Silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	100	95-100	70-90	20-30	NP-10

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
7*:											
Brocko Variant--	0-5	Silt loam--------	CL-ML	A-4	0	95-100	90-100	85-100	75-90	25-30	5-10
	5-23	Silty clay loam, silt loam.	CL-ML	A-4	0	100	95-100	90-100	80-95	25-30	5-10
	23-60	Silt loam, silty clay loam.	CL-ML	A-4	0	95-100	90-100	85-100	75-95	25-30	5-10
8*:											
Aquic Cryoboralfs.											
Typic Cryochrepts.											
9*:											
Armitage--------	0-5	Cobbly loam------	CL-ML	A-4	15-40	95-100	90-95	75-90	55-70	25-30	5-10
	5-7	Clay-------------	CL	A-7	0	95-100	90-100	80-100	70-95	40-50	20-30
	7-13	Clay loam, loam	CL	A-6	0	95-100	90-100	80-95	60-75	30-35	10-15
	13-36	Silt loam--------	CL-ML, SM-SC	A-4	0	95-100	90-100	70-95	40-80	20-25	5-10
	36-60	Very gravelly sand, extremely gravelly sand.	GP	A-1	10-25	30-50	25-40	15-30	0-5	---	NP
Thess-----------	0-6	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-95	60-75	20-35	5-15
	6-30	Loam, silt loam	CL-ML, CL	A-4, A-6	0-5	90-100	85-95	80-95	60-80	20-35	5-15
	30-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly sand.	GP, GP-GM	A-1	0-15	20-35	15-30	10-20	0-10	---	NP
10--------------- Attewan	0-4	Loam-------------	ML, CL-ML	A-4	0-5	85-100	80-100	70-90	55-75	20-30	NP-10
	4-8	Clay loam, sandy clay loam, gravelly loam.	CL, SC	A-6	0-5	75-100	70-100	55-85	35-70	30-40	10-20
	8-24	Clay loam, gravelly loam, sandy clay loam.	CL, SC, GC	A-6	0-5	70-100	65-100	50-85	35-65	30-40	10-20
	24-60	Very gravelly loamy sand, extremely gravelly loamy sand, very gravelly sand.	GP, GP-GM, GM, SM	A-1	0-15	25-55	15-50	5-20	0-15	---	NP
11--------------- Attewan	0-4	Loam-------------	ML, CL-ML	A-4	0-5	85-100	80-100	70-90	55-75	20-30	NP-10
	4-10	Clay loam, sandy clay loam, gravelly loam.	CL, SC	A-6	0-5	75-100	70-100	55-85	35-70	30-40	10-20
	10-35	Clay loam, gravelly loam, sandy clay loam.	CL, SC, GC	A-6	0-5	70-100	65-100	50-85	35-65	30-40	10-20
	35-60	Very gravelly loamy sand, extremely gravelly loamy sand, very gravelly sand.	GP, GP-GM, GM, SM	A-1	0-15	25-55	15-50	5-20	0-15	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
12----------------- Attewan	0-4	Cobbly loam-------	CL-ML, GM-GC, SM-SC	A-4	15-25	70-95	65-90	55-85	40-70	20-30	5-10
	4-11	Clay loam, sandy clay loam, gravelly loam.	CL-ML, CL, SM-SC, SC	A-4, A-6, A-2	0-10	70-90	65-85	50-85	25-70	25-40	5-15
	11-20	Clay loam, gravelly loam, silt loam.	CL-ML, CL, GM-GC, SM-SC	A-4, A-6	0-10	65-90	60-85	50-85	35-75	20-35	5-15
	20-60	Very gravelly loamy sand, extremely gravelly loamy sand, very gravelly sand.	GP, GP-GM, GM	A-1	0-25	20-55	15-50	10-40	0-15	---	NP
13----------------- Attewan	0-5	Very stony loam	CL-ML, GM-GC, SM-SC	A-4	25-50	70-85	65-80	55-75	40-60	20-30	5-10
	5-9	Clay loam, sandy clay loam, gravelly loam.	CL-ML, CL, SM-SC, SC	A-4, A-6, A-2	0-10	70-90	65-85	50-85	25-70	25-40	5-15
	9-20	Clay loam, gravelly loam, silt loam.	CL-ML, CL, GM-GC, SM-SC	A-4, A-6	0-10	65-90	60-85	50-85	35-75	20-35	5-15
	20-60	Very gravelly loamy sand, extremely gravelly loamy sand, very gravelly sand.	GP, GP-GM, GM	A-1	0-25	20-55	15-50	10-40	0-15	---	NP
14*. Badland											
15----------------- Bearmouth	0-7	Gravelly loam-----	ML, SM, GM	A-4, A-2	10-15	70-90	60-85	50-70	30-55	20-30	NP-5
	7-15	Very gravelly sandy loam, very gravelly loam, very stony loam.	GM, SM	A-1, A-2	25-45	45-70	40-60	25-50	10-35	20-30	NP-5
	15-60	Extremely cobbly sand, extremely gravelly sand, extremely gravelly loamy sand.	GP, GP-GM	A-1	40-65	20-50	10-40	5-25	0-10	---	NP
16----------------- Bearmouth	0-6	Extremely stony loam.	SM-SC, CL-ML, CL, SC	A-2, A-4, A-6	65-85	70-95	55-85	45-80	30-65	20-30	5-15
	6-20	Very stony sandy loam, very gravelly loam, very stony loam.	GM, SM	A-1, A-2	25-45	45-70	40-60	25-50	10-35	20-30	NP-5
	20-60	Extremely cobbly sand, extremely gravelly sand, extremely gravelly loamy sand.	GP, GP-GM	A-1	40-65	20-50	10-40	5-25	0-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17---------------- Beaverell	0-4	Cobbly loam------	ML, CL-ML, SM, SM-SC	A-4	15-30	80-100	70-90	55-80	45-70	20-30	NP-10
	4-17	Very gravelly clay loam, very gravelly sandy clay loam, very gravelly loam.	GC, GM-GC	A-2	0-25	40-60	30-50	20-45	15-35	25-40	5-15
	17-60	Stratified very gravelly loamy sand.	GM, SM, GP-GM, SP-SM	A-1	10-45	35-65	25-55	10-45	5-15	---	NP
18*:											
Blackhall-------	0-2	Sandy loam-------	SM	A-4, A-2	0-5	90-100	85-100	50-70	25-40	15-25	NP-5
	2-16	Fine sandy loam, sandy loam, very fine sandy loam.	SM	A-4	0-5	90-100	85-100	60-80	35-50	15-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
19---------------- Blaine	0-6	Stony loam-------	CL-ML	A-4	10-30	85-95	80-95	70-90	50-70	20-30	5-10
	6-10	Very gravelly clay loam, very stony clay loam.	GC	A-6	15-30	55-65	50-60	45-55	35-45	25-40	10-20
	10-25	Very stony loam, extremely stony sandy loam.	GM-GC	A-2, A-4	25-55	30-70	25-65	20-55	15-40	20-30	5-10
	25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
20. Borohemists											
21---------------- Branham	0-4	Coarse sandy loam	SM, SM-SC	A-4, A-2	0	90-100	75-100	45-70	25-40	20-30	NP-10
	4-22	Gravelly coarse sandy loam, coarse sandy loam.	SM, SM-SC	A-1, A-2	0	75-95	50-85	30-60	15-35	20-30	NP-10
	22-30	Gravelly coarse sand, gravelly loamy coarse sand.	SM, SP-SM	A-1	0	75-90	50-75	25-50	5-25	---	NP
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
22*:											
Branham---------	0-4	Coarse sandy loam	SM, SM-SC	A-4, A-2	0	90-100	75-100	45-70	25-40	20-30	NP-10
	4-22	Gravelly coarse sandy loam, coarse sandy loam.	SM, SM-SC	A-1, A-2	0	75-95	50-85	30-60	15-35	20-30	NP-10
	22-30	Gravelly coarse sand, gravelly loamy coarse sand.	SM, SP-SM	A-1	0	75-90	50-75	25-50	5-25	---	NP
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
23--------------- Bridger	0-7	Clay loam--------	CL-ML, CL	A-4, A-6	0-10	90-100	85-95	75-90	55-70	25-40	5-15
	7-17	Clay, gravelly clay loam, silty clay.	CL, GC, SC	A-6, A-7	0-15	65-100	60-95	55-90	40-75	35-50	15-30
	17-21	Gravelly clay loam, clay loam, loam.	CL-ML, CL, GM-GC, SM-SC	A-6, A-4	0-15	65-100	60-95	50-85	35-70	25-40	5-20
	21-60	Gravelly loam, very gravelly clay loam, very gravelly sandy clay loam.	GM-GC, GC, SM-SC, SC	A-6, A-4, A-2	0-25	45-75	35-65	25-60	20-50	25-35	5-15
24--------------- Bridger	0-7	Cobbly clay loam	CL-ML, CL	A-4, A-6	15-30	75-100	70-95	65-90	50-75	25-40	5-15
	7-17	Clay, gravelly clay loam, silty clay.	CL, GC, SC	A-6, A-7	0-15	65-100	60-95	55-90	40-75	35-50	15-30
	17-21	Gravelly clay loam, loam, cobbly clay loam.	CL-ML, CL, GM-GC, SM-SC	A-6, A-4	0-25	70-100	65-95	50-85	35-70	25-40	5-20
	21-60	Gravelly loam, very gravelly clay loam, very cobbly sandy clay loam.	GM-GC, GC, SM-SC, SC	A-6, A-4, A-2	0-25	45-75	35-65	25-60	20-50	25-35	5-15
25*:											
Bridger---------	0-7	Cobbly clay loam	CL-ML, CL	A-4, A-6	15-30	75-100	70-95	65-90	50-75	25-40	5-15
	7-17	Clay, gravelly clay loam, silty clay.	CL, GC, SC	A-6, A-7	0-15	65-100	60-95	55-90	40-75	35-50	15-30
	17-21	Gravelly clay loam, loam, cobbly clay loam.	CL-ML, CL, GM-GC, SM-SC	A-6, A-4	0-25	70-100	65-95	50-85	35-70	25-40	5-20
	21-60	Gravelly loam, very gravelly clay loam, very cobbly sandy clay loam.	GM-GC, GC, SM-SC, SC	A-6, A-4, A-2	0-25	45-75	35-65	25-60	20-50	25-35	5-15
Cryaquolls.											
26*:											
Bridger---------	0-7	Cobbly clay loam	CL-ML, CL	A-4, A-6	15-30	75-100	70-95	65-90	50-75	25-40	5-15
	7-17	Clay, gravelly clay loam, silty clay.	CL, GC, SC	A-6, A-7	0-15	65-100	60-95	55-90	40-75	35-50	15-30
	17-21	Gravelly clay loam, loam, cobbly clay loam.	CL-ML, CL, GM-GC, SM-SC	A-6, A-4	0-25	70-100	65-95	50-85	35-70	25-40	5-20
	21-60	Gravelly loam, very gravelly clay loam, very cobbly sandy clay loam.	GM-GC, GC, SM-SC, SC	A-6, A-4, A-2	0-25	45-75	35-65	25-60	20-50	25-35	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26*:											
Tiban	0-8	Cobbly loam	CL-ML, SM-SC	A-4	15-30	75-100	70-90	60-80	45-70	20-30	5-10
	8-14	Gravelly clay loam, cobbly loam, very stony loam.	GM-GC, GC, SM-SC, CL-ML	A-4, A-6, A-2	10-30	50-85	45-80	40-70	30-55	20-35	5-15
	14-18	Very gravelly clay loam, very cobbly loam, very stony loam.	GM-GC, GC, SM-SC, SC	A-4, A-6, A-2	25-30	40-70	35-65	30-60	25-50	20-35	5-15
	18-60	Very gravelly clay loam, very cobbly loam, very stony loam.	GM-GC, GC, SM-SC, SC	A-4, A-6, A-2	25-30	45-75	35-65	30-55	20-45	20-35	5-15
Adel	0-23	Loam	CL-ML	A-4	0-5	85-100	80-100	65-95	55-85	25-30	5-10
	23-37	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	85-100	80-100	65-95	55-80	25-35	5-15
	37-60	Clay loam, channery loam, gravelly loam.	CL, CL-ML, SM-SC, GM-GC	A-6, A-4	0-10	70-100	60-90	55-85	40-75	25-35	5-15
27, 28 Brocko	0-8	Silt loam	ML, CL-ML	A-4	0	100	100	85-95	70-90	20-30	NP-10
	8-17	Silt loam, loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	100	95-100	70-90	20-30	NP-10
	17-60	Silt loam, loam, very fine sandy loam.	ML, CL-ML	A-4	0	90-100	85-100	80-85	55-75	20-30	NP-10
29*:											
Brocko	0-4	Silt loam	ML, CL-ML	A-4	0	100	100	85-95	70-90	20-30	NP-10
	4-12	Silt loam, loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	100	95-100	70-90	20-30	NP-10
	12-60	Silt loam, loam, very fine sandy loam.	ML, CL-ML	A-4	0	90-100	85-100	80-85	55-75	20-30	NP-10
Crago	0-4	Gravelly loam	GM-GC, GM, CL-ML, SM-SC	A-4	0-10	60-75	55-70	50-65	35-55	20-30	NP-10
	4-14	Gravelly loam, gravelly clay loam, very gravelly clay loam.	GC, GM-GC	A-2, A-4, A-6	0-15	30-65	25-60	20-55	15-45	25-35	5-15
	14-60	Extremely gravelly loam, very gravelly clay loam, very gravelly sandy loam.	GM, GM-GC, GP-GM	A-1, A-2	0-15	25-45	15-35	10-25	5-20	20-30	NP-10
30 Brocko Variant	0-5	Silt loam	CL-ML	A-4	0	95-100	90-100	85-100	75-90	25-30	5-10
	5-23	Silty clay loam, silt loam.	CL-ML	A-4	0	100	95-100	90-100	80-95	25-30	5-10
	23-60	Silt loam, silty clay loam.	CL-ML	A-4	0	95-100	90-100	85-100	75-95	25-30	5-10

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
31-----Bullrey	0-21	Loam-----	CL-ML	A-4	---	90-100	85-100	70-95	50-75	25-30	5-10
	21-39	Gravelly loam----	SM-SC, CL-ML, GM-GC	A-4, A-2	0-5	60-85	55-75	45-70	30-60	25-30	5-10
	39-48	Very gravelly fine sandy loam.	GM, SM	A-2, A-4	0-10	45-65	30-50	20-45	10-30	20-25	NP-5
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
32*:											
Comad-----	0-17	Very stony loamy sand.	SM	A-2, A-1, A-4	25-45	65-90	55-80	35-65	15-40	---	NP
	17-42	Extremely stony sand, extremely stony loamy sand, very stony loamy sand.	GM, SM, GP-GM, SP-SM	A-1	45-75	45-85	35-75	10-45	5-20	---	NP
	42-66	Extremely stony loamy sand, extremely stony sand, very stony loamy sand.	GM, SM, GP-GM, SP-SM	A-1	45-75	45-85	35-75	10-45	5-20	---	NP
Earcree-----	0-18	Gravelly sandy loam.	SM	A-4, A-2	0-10	65-85	55-75	40-60	25-45	20-25	NP-5
	18-63	Very gravelly loamy coarse sand, gravelly coarse sandy loam, coarse sandy loam.	SM, GM	A-1, A-2	0-15	45-95	40-90	20-50	10-35	15-25	NP-5
33-----Crago	0-4	Gravelly loam----	GM-GC, GM, CL-ML, SM-SC	A-4	0-10	60-75	55-70	50-65	35-55	20-30	NP-10
	4-14	Gravelly loam, gravelly clay loam, very gravelly clay loam.	GC, GM-GC	A-2, A-4, A-6	0-15	30-65	25-60	20-55	15-45	25-35	5-15
	14-32	Extremely gravelly loam, very gravelly clay loam, very gravelly sandy loam.	GM, GM-GC, GP-GM	A-1, A-2	0-15	25-45	15-35	10-25	5-20	20-30	NP-10
	32-60	Extremely gravelly loamy sand, extremely gravelly sandy loam, very gravelly sandy loam.	GP, GP-GM, GM	A-1	0-15	30-50	15-35	5-20	0-15	15-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
34---------------- Crago	0-4	Gravelly loam----	GM-GC, GM, CL-ML, SM-SC	A-4	0-10	60-75	55-70	50-65	35-55	20-30	NP-10
	4-14	Gravelly loam, gravelly clay loam, very gravelly clay loam.	GC, GM-GC	A-2, A-4, A-6	0-15	30-65	25-60	20-55	15-45	25-35	5-15
	14-60	Extremely gravelly loam, very gravelly clay loam, very gravelly sandy loam.	GM, GM-GC, GP-GM	A-1, A-2	0-15	25-45	15-35	10-25	5-20	20-30	NP-10
35---------------- Crago	0-4	Very stony loam	ML, CL-ML, SM, GM	A-4	15-30	65-85	60-80	50-70	40-60	20-30	NP-10
	4-15	Very stony loam, very cobbly clay loam, gravelly loam.	GM-GC, GC, SM-SC, CL	A-4, A-6, A-2	10-45	50-80	45-75	40-70	30-60	25-35	5-15
	15-60	Very cobbly loam, extremely cobbly sandy loam, very gravelly clay loam.	GM, GM-GC	A-2, A-1	25-55	30-50	25-45	20-40	15-35	20-30	NP-10
36*:											
Crago-----------	0-4	Very stony loam	ML, CL-ML, SM, GM	A-4	15-30	65-85	60-80	50-70	40-60	20-30	NP-10
	4-15	Very stony loam, very cobbly clay loam, gravelly loam.	GM-GC, GC, SM-SC, CL	A-4, A-6, A-2	10-45	50-80	45-75	40-70	30-60	25-35	5-15
	15-60	Very cobbly loam, extremely cobbly sandy loam, very gravelly clay loam.	GM, GM-GC	A-2, A-1	25-55	30-50	25-45	20-40	15-35	20-30	NP-10
Kalsted---------	0-4	Gravelly sandy loam.	SM	A-1, A-2	0	60-80	50-75	30-55	15-30	20-25	NP-5
	4-60	Gravelly sandy loam.	SM	A-1, A-2	0	60-80	50-75	30-55	15-30	20-25	NP-5
Pensore---------	0-4	Very channery loam.	GM, GM-GC	A-1, A-2	0-10	40-60	30-50	20-45	20-35	20-30	NP-10
	4-16	Very channery loam.	GM, GM-GC	A-1, A-2	5-10	40-65	35-55	20-45	20-35	20-30	NP-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
37*:											
Crago	0-4	Very gravelly loam.	GM, GM-GC	A-4, A-2	10-25	40-60	35-55	30-50	25-45	20-30	NP-10
	4-26	Gravelly loam, gravelly clay loam, very gravelly clay loam.	GC, GM-GC	A-2, A-4, A-6	0-15	30-65	25-60	20-55	15-45	25-35	5-15
	26-60	Extremely gravelly loam, very gravelly sandy loam, extremely gravelly sandy loam.	GM, GM-GC, GP-GM	A-1, A-2	0-15	25-45	15-35	10-25	5-20	20-30	NP-10
Scravo	0-4	Cobbly sandy loam	SM, SM-SC	A-2	15-25	80-85	75-80	40-55	25-30	15-25	NP-10
	4-14	Very gravelly sandy loam, extremely gravelly sandy loam.	GM, SM	A-1	10-25	35-60	30-55	20-35	10-20	15-25	NP-5
	14-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly sand.	GP, GP-GM, GM, SP-SM	A-1	10-25	35-60	30-55	15-35	0-15	---	NP
38. Cryaquolls											
39. Cryoborolls											
40. Cryorthents											
41 Earcree	0-16	Sandy loam	SM	A-2, A-4	0-15	85-100	80-100	40-70	25-40	20-25	NP-5
	16-60	Sandy loam, gravelly loamy coarse sand, coarse sandy loam.	SM	A-1, A-2	0-15	75-95	65-90	40-50	20-35	15-25	NP-5
42 Earcree	0-16	Gravelly sandy loam.	SM	A-1, A-2	0-15	75-95	65-75	40-50	20-30	20-25	NP-5
	16-60	Gravelly sandy loam, gravelly loamy coarse sand, coarse sandy loam.	SM	A-1, A-2	0-15	75-95	65-90	40-50	20-35	15-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
43--------------- Earcree	0-28	Gravelly sandy loam.	SM	A-1, A-2	0-15	75-95	65-75	40-50	20-30	20-25	NP-5
	28-60	Gravelly sandy loam, gravelly loamy coarse sand, coarse sandy loam.	SM	A-1, A-2	0-15	75-95	65-90	40-50	20-35	15-25	NP-5
44*: Earcree----------	0-16	Gravelly sandy loam.	SM	A-1, A-2	0-15	75-95	65-75	40-50	20-30	20-25	NP-5
	16-60	Gravelly sandy loam, gravelly loamy coarse sand, coarse sandy loam.	SM	A-1, A-2	0-15	75-95	65-90	40-50	20-35	15-25	NP-5
Branham----------	0-4	Coarse sandy loam	SM, SM-SC	A-4, A-2	0	90-100	75-100	45-70	25-40	20-30	NP-10
	4-22	Gravelly coarse sandy loam, coarse sandy loam.	SM, SM-SC	A-1, A-2	0	75-95	50-85	30-60	15-35	20-30	NP-10
	22-30	Gravelly coarse sand, gravelly loamy coarse sand.	SM, SP-SM	A-1	0	75-90	50-75	25-50	5-25	---	NP
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
45. Fluvaquentic Haplaquolls											
46--------------- Garlet	0-15	Very channery sandy loam.	GM, SM	A-1	10-25	45-65	35-55	20-40	10-20	15-25	NP-5
	15-26	Very channery sandy loam, very cobbly sandy loam, extremely flaggy loam.	GM, GM-GC	A-1, A-2	25-55	25-60	20-55	15-45	10-30	20-30	NP-10
	26-60	Very channery sandy loam, extremely cobbly loam, very flaggy loam.	GM, GM-GC	A-1, A-2	25-55	25-60	20-50	15-45	10-30	15-30	NP-10

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
47*:											
Garlet	0-4	Very channery sandy loam.	GM, SM	A-1	10-25	45-65	35-55	20-40	10-20	15-25	NP-5
	4-15	Very channery sandy loam, extremely flaggy loam, very cobbly loam.	GM, GM-GC	A-1, A-2	15-50	35-65	30-60	25-50	15-35	20-30	NP-10
	15-26	Very channery sandy loam, very cobbly sandy loam, extremely flaggy loam.	GM, GM-GC	A-1, A-2	25-55	25-60	20-55	15-45	10-30	20-30	NP-10
	26-60	Very channery sandy loam, extremely cobbly loam, very flaggy loam.	GM, GM-GC	A-1, A-2	25-55	25-60	20-50	15-45	10-30	15-30	NP-10
Rock outcrop.											
48*:											
Gaylord	0-9	Loam	CL-ML	A-4	0	100	100	85-95	65-75	25-30	5-10
	9-22	Silty clay, silty clay loam, clay.	CL, CH	A-7, A-6	0	100	95-100	95-100	85-95	35-55	15-30
	22-60	Silty clay, silty clay loam.	CL	A-7, A-6	0	100	95-100	95-100	85-95	35-50	15-30
Burnette	0-13	Clay loam	CL-ML, CL	A-4, A-6	0-5	85-100	80-100	75-95	70-90	25-35	5-15
	13-26	Clay, clay loam, silty clay.	CL, CH	A-7	0-10	90-100	85-100	70-95	65-90	40-55	15-30
	26-60	Clay, clay loam, silty clay, gravelly clay.	CL	A-6, A-7	0-10	75-100	70-100	65-95	55-90	35-50	15-25
49, 50 Hanson	0-11	Channery loam	ML, GM, SM	A-4	0-5	60-80	55-75	45-65	40-60	20-35	NP-10
	11-60	Very channery loam, very gravelly clay loam, very gravelly loam.	GM	A-2, A-1, A-4	5-15	40-65	30-55	25-50	20-45	20-35	NP-10
51*:											
Hanson	0-7	Stony loam	ML, CL-ML	A-4	15-25	75-100	65-90	60-85	50-75	15-30	NP-10
	7-14	Stony loam, cobbly clay loam, very stony loam.	SM, ML, GM, CL-ML	A-4	15-40	65-100	55-90	50-85	35-75	15-30	NP-10
	14-60	Very cobbly loam, extremly gravelly loam, very cobbly clay loam.	GM, GM-GC	A-2, A-4	15-40	50-70	40-60	35-50	25-45	15-30	NP-10
Adel	0-23	Loam	CL-ML	A-4	0-5	85-100	80-100	65-95	55-85	25-30	5-10
	23-60	Clay loam, channery loam, gravelly loam.	CL, CL-ML, SM-SC, GM-GC	A-6, A-4	0-10	70-100	60-90	55-85	40-75	25-35	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
52*:											
Hanson----------	0-11	Stony loam-------	ML, CL-ML	A-4	15-25	75-100	65-90	60-85	50-75	15-30	NP-10
	11-60	Very channery loam, very gravelly loam, very cobbly clay loam.	GM, GM-GC	A-2, A-1, A-4	5-15	40-65	30-55	25-50	20-45	15-30	NP-10
Raynesford------	0-16	Stony silt loam	GM, SM, ML, CL-ML	A-4	10-20	65-90	60-85	50-80	40-70	15-25	NP-10
	16-20	Clay loam, gravelly silt loam, loam.	GM-GC, SM, CL-ML, CL	A-4, A-6	0-15	65-100	60-100	50-90	40-75	20-35	NP-15
	20-60	Gravelly clay loam, gravelly silty clay loam, gravelly silt loam.	GM, GM-GC, CL-ML, CL	A-4, A-6, A-2	0-15	60-80	55-75	50-70	40-65	20-35	NP-15
53*:											
Hanson----------	0-11	Channery loam----	ML, GM, SM	A-4	0-5	60-80	55-75	45-65	40-60	20-35	NP-10
	11-60	Very channery loam, very gravelly clay loam, very gravelly loam.	GM	A-2, A-1, A-4	5-15	40-65	30-55	25-50	20-45	20-35	NP-10
Rock outcrop.											
54, 55----------- Hapgood	0-12	Loam-------------	CL-ML	A-4	0-5	85-100	80-95	70-90	50-70	25-30	5-10
	12-60	Very gravelly loam, very gravelly clay loam.	GM-GC, GC	A-4, A-2, A-6	15-25	45-70	35-60	25-50	20-45	25-35	5-15
56--------------- Hapgood	0-18	Very stony loam	GM-GC, SM-SC, CL-ML	A-4	30-55	60-80	50-70	40-60	35-55	25-30	5-10
	18-60	Very cobbly loam, very gravelly loam, very cobbly clay loam.	GM-GC, GC	A-4, A-2	15-40	50-70	40-60	30-50	25-45	25-35	5-15
57*:											
Hapgood---------	0-18	Very stony loam	GM-GC, SM-SC, CL-ML	A-4	30-55	60-80	50-70	40-60	35-55	25-30	5-10
	18-60	Very cobbly loam, very gravelly loam, very cobbly clay loam.	GM-GC, GC	A-4, A-2	15-40	50-70	40-60	30-50	25-45	25-35	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
57*:											
Sebud	0-14	Very stony loam	ML, SM, CL-ML, SM-SC	A-4	15-40	75-95	60-85	50-80	35-65	20-30	NP-10
	14-30	Very stony clay loam, very stony sandy clay loam, very stony sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	40-60	75-95	60-85	50-80	40-70	25-40	5-15
	30-46	Very stony clay loam, very stony sandy clay loam, very stony sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	40-60	75-95	60-85	50-85	40-70	25-40	5-15
	46-60	Very stony sandy clay loam, very stony sandy loam, very stony clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	40-60	75-95	60-85	45-75	35-60	25-40	5-15
58 Havre	0-9	Loam	CL-ML	A-4	0	100	100	80-95	60-90	20-30	5-10
	9-60	Stratified fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	100	100	70-95	60-80	20-35	5-15
59 Havre	0-9	Loam	CL-ML	A-4	0	100	100	85-95	60-75	25-30	5-10
	9-60	Stratified loam to clay loam.	CL-ML, CL	A-4, A-6	0	100	100	85-95	60-75	25-40	5-15
60 Kalsted	0-12	Loamy sand	SM	A-1, A-2	0	80-100	75-100	40-70	10-30	---	NP
	12-30	Sandy loam	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5
	30-60	Stratified gravelly sandy loam to loamy sand.	SM	A-1, A-2	0	60-100	50-90	30-55	15-30	20-25	NP-5
61, 62 Kalsted	0-11	Sandy loam	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5
	11-30	Sandy loam	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5
	30-60	Stratified gravelly sandy loam to loamy sand.	SM	A-1, A-2	0	60-100	50-90	30-55	15-30	20-25	NP-5
63 Kalsted	0-7	Sandy loam	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5
	7-30	Sandy loam	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5
	30-60	Stratified gravelly sandy loam to loamy sand.	SM	A-1, A-2	0	60-100	50-90	30-55	15-30	20-25	NP-5
64 Kalsted	0-4	Gravelly sandy loam.	SM	A-1, A-2	0	60-80	50-75	30-55	15-30	20-25	NP-5
	4-60	Gravelly sandy loam.	SM	A-1, A-2	0	60-80	50-75	30-55	15-30	20-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
65--------------- Larry Variant	0-5	Peat-------------	PT	A-8	---	---	---	---	---	---	---
	5-12	Loam-------------	ML, OL	A-4	0-5	85-100	80-100	70-95	50-75	25-40	NP-10
	12-29	Clay loam, loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-6, A-4	0-5	85-100	80-100	70-90	45-75	25-35	5-15
	29-37	Very gravelly sandy loam.	GM-GC	A-2	0-20	35-55	30-50	20-35	10-20	20-30	5-10
	37-65	Very gravelly loamy sand.	GP-GM, GM	A-1	0-20	35-55	30-50	15-40	5-15	20-25	NP-5
66--------------- Leavitt	0-15	Loam-------------	ML, CL-ML, SM	A-4	0	75-100	75-100	70-90	40-60	20-30	NP-10
	15-40	Clay loam, gravelly clay loam, cobbly clay loam.	CL, CL-ML	A-6, A-4	0-20	75-100	70-100	70-100	55-80	25-35	5-15
	40-60	Very gravelly loam, gravelly loam.	SM, GM	A-2, A-4	0-20	60-90	45-75	40-70	30-50	25-30	5-10
67--------------- Leavitt	0-7	Cobbly loam------	CL-ML, ML	A-4	15-25	85-95	80-90	70-80	55-65	20-30	NP-10
	7-21	Stony clay loam, gravelly clay loam, loam.	CL, CL-ML	A-4, A-6	10-15	80-95	75-90	65-80	50-70	25-35	5-15
	21-60	Gravelly loam, clay loam, stony loam.	CL-ML	A-4	10-15	80-95	75-90	65-80	50-70	25-30	5-10
68--------------- Leavitt	0-4	Stony loam-------	CL-ML, ML	A-4	10-25	85-100	80-95	70-85	55-70	20-30	NP-10
	4-21	Stony clay loam, gravelly clay loam, loam.	CL, CL-ML	A-4, A-6	10-15	80-95	75-90	65-80	50-70	25-35	5-15
	21-60	Gravelly loam, clay loam, stony loam.	CL-ML	A-4	10-15	80-95	75-90	65-80	50-70	25-30	5-10
69*:											
Leavitt---------	0-10	Gravelly loam----	GM, GM-GC, SM, SM-SC	A-4	0-10	70-80	65-75	55-65	40-50	20-30	NP-10
	10-35	Stony clay loam, gravelly clay loam, loam.	CL, CL-ML	A-4, A-6	10-15	80-95	75-90	65-80	50-70	25-35	5-15
	35-45	Gravelly loam, clay loam, stony loam.	CL-ML	A-4	10-15	80-95	75-90	65-80	50-70	25-30	5-10
	45-60	Very gravelly loam, very stony sandy loam.	GM, GM-GC	A-2, A-4	15-40	45-65	40-60	30-50	25-45	20-30	NP-10
Adel------------	0-21	Loam-------------	CL-ML	A-4	0-5	85-100	80-100	65-95	55-85	25-30	5-10
	21-55	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	85-100	80-100	65-95	55-80	25-35	5-15
	55-60	Clay loam, channery loam, gravelly loam.	CL, CL-ML, SM-SC, GM-GC	A-6, A-4	0-10	70-100	60-90	55-85	40-75	25-35	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
70*:											
Libeg-----------	0-7	Very stony loam	GM-GC, SM-SC, CL-ML	A-2, A-4	40-65	55-90	45-80	35-65	30-60	20-30	5-10
	7-33	Very stony loam, very stony clay loam, extremely stony clay loam.	GC, GM-GC	A-2, A-4, A-6	25-65	35-60	30-55	25-50	20-45	20-35	5-15
	33-60	Extremely stony sandy clay loam, very stony clay loam, very stony loam.	GC, GM-GC	A-4, A-6, A-2	30-65	35-65	30-60	25-55	20-45	25-35	5-15
Adel------------	0-21	Gravelly loam----	ML, SM, GM, CL-ML	A-4	0-10	60-85	55-75	45-70	35-55	20-30	NP-10
	21-60	Clay loam, gravelly loam, channery loam.	CL, CL-ML, SM-SC, GM-GC	A-6, A-4	0-15	70-100	65-90	60-85	40-75	25-35	5-15
71*:											
Libeg-----------	0-13	Very stony loam	GM-GC, SM-SC, CL-ML	A-2, A-4	40-65	55-90	45-80	35-65	30-60	20-30	5-10
	13-30	Very stony loam, very cobbly clay loam, extremely cobbly clay loam.	GC, GM-GC	A-2, A-4, A-6	25-65	35-60	30-55	25-50	20-45	20-35	5-15
	30-60	Very cobbly sandy clay loam, very stony clay loam, extremely cobbly loam.	GC, GM-GC	A-4, A-6, A-2	30-65	35-65	30-60	25-55	20-45	25-35	5-15
Hapgood---------	0-18	Stony loam-------	CL-ML, SM-SC, GM-GC	A-4	15-30	65-85	55-75	50-70	40-65	25-30	5-10
	18-60	Very cobbly loam, very gravelly loam, very cobbly clay loam.	GM-GC, GC	A-4, A-2	15-40	50-70	40-60	30-50	25-45	25-35	5-15
72--------------- Loberg	0-11	Very stony loam	GM-GC	A-4, A-2	25-45	50-70	45-65	35-60	25-50	25-30	5-10
	11-18	Very stony clay, very channery clay loam, very stony clay loam.	GC	A-6, A-7, A-2	25-45	45-70	40-65	30-55	25-50	35-50	15-30
	18-42	Very stony clay, very cobbly clay loam, very stony clay loam.	GC, SC, CL	A-6, A-7, A-2	40-55	55-85	50-80	35-70	30-65	35-50	15-30
	42-60	Very stony clay, very channery clay loam, very stony clay loam.	GC	A-2, A-6, A-7	25-45	45-70	40-65	30-50	25-45	35-45	15-25

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
73--------------- MacFarlane	0-14	Stony sandy loam	SM, GM	A-2, A-1	25-50	55-80	45-70	30-55	10-35	---	NP
	14-70	Very channery sandy loam, extremely channery sandy loam, very stony sandy loam.	GM, GP-GM, SM, SP-SM	A-2, A-1	15-45	30-70	20-60	15-50	5-30	20-30	NP-10
	70-80	Very cobbly loamy sand, extremely stony sandy loam, very channery sandy loam.	GP-GM, SP-SM, GM, SM	A-1	20-45	30-65	20-55	15-45	5-25	---	NP
74--------------- MacFarlane	0-14	Very stony sandy loam.	SM, GM	A-2, A-1	25-50	55-80	45-70	30-55	10-35	---	NP
	14-70	Very channery sandy loam, extremely channery sandy loam, very stony sandy loam.	GM, GP-GM, SM, SP-SM	A-2, A-1	15-45	30-70	20-60	15-50	5-30	20-30	NP-10
	70-80	Very cobbly loamy sand, extremely stony sandy loam, very channery sandy loam.	GP-GM, SP-SM, GM, SM	A-1	20-45	30-65	20-55	15-45	5-25	---	NP
75--------------- Marias	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	10-20
	6-60	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	90-100	75-95	40-70	25-50
76--------------- Maxville	0-11	Gravelly loam----	CL-ML, GM-GC, SM-SC	A-4	10-15	65-90	60-85	50-80	35-65	25-30	5-10
	11-19	Loam, clay loam, gravelly loam.	CL-ML, CL, SM-SC, GM-GC	A-4, A-6	0-15	70-100	65-95	55-90	40-75	25-35	5-15
	19-34	Loam, clay loam, gravelly loam.	CL-ML, CL, SM-SC, GM-GC	A-4, A-6	0-15	65-90	60-85	50-80	35-70	25-35	5-15
	34-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly loamy sand.	GP-GM, GP	A-1	0-30	30-40	25-35	15-25	0-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
77--------------- Maxville	0-8	Cobbly loam------	CL-ML, SM-SC	A-4	15-30	75-95	70-90	60-85	40-70	25-30	5-10
	8-21	Loam, clay loam, gravelly loam.	CL-ML, CL, SM-SC, GM-GC	A-4, A-6	0-15	70-100	65-95	55-90	40-75	25-35	5-15
	21-26	Loam, clay loam, gravelly loam.	CL-ML, CL, SM-SC, GM-GC	A-4, A-6	0-15	65-90	60-85	50-80	35-70	25-35	5-15
	26-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly loamy sand.	GP-GM, GP	A-1	0-30	30-40	25-35	15-25	0-10	---	NP
78*: Maxville--------	0-8	Loam-------------	CL-ML, SM-SC	A-4	0	80-100	75-95	65-90	45-70	25-30	5-10
	8-21	Loam, clay loam, gravelly loam.	CL-ML, CL, SM-SC, GM-GC	A-4, A-6	0-15	70-100	65-95	55-90	40-75	25-35	5-15
	21-26	Loam, clay loam, gravelly loam.	CL-ML, CL, SM-SC, GM-GC	A-4, A-6	0-15	65-90	60-85	50-80	35-70	25-35	5-15
	26-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly loamy sand.	GP-GM, GP	A-1	0-30	30-40	25-35	15-25	0-10	---	NP
Bearmouth-------	0-7	Extremely stony loam.	ML	A-4	15-25	85-95	80-90	65-85	50-70	20-30	NP-5
	7-16	Very gravelly sandy loam, very gravelly loam, very stony loam.	GM, SM	A-1, A-2	25-45	45-70	40-60	25-50	10-35	20-30	NP-5
	16-60	Extremely cobbly sand, extremely gravelly sand, extremely gravelly loamy sand.	GP, GP-GM	A-1	40-65	20-50	10-40	5-25	0-10	---	NP
79*: Maxville--------	0-9	Loam-------------	CL-ML, SM-SC	A-4	0	80-100	75-95	65-90	45-70	25-30	5-10
	9-21	Loam, clay loam, gravelly loam.	CL-ML, CL, SM-SC, GM-GC	A-4, A-6	0-15	70-100	65-95	55-90	40-75	25-35	5-15
	21-36	Loam, gravelly loam, clay loam.	CL-ML, CL, SM-SC, GM-GC	A-4, A-6	0-15	65-90	60-85	50-80	35-70	25-35	5-15
	36-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly loamy sand.	GP-GM, GP	A-1	0-30	35-45	25-35	15-25	0-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
79*:											
Bearmouth-------	0-6	Extremely stony loam.	ML	A-4	15-25	85-95	80-90	65-85	50-70	25-30	NP-5
	6-20	Very gravelly sandy loam, very gravelly loam, very stony loam.	GM, SM	A-1, A-2	25-45	45-70	40-60	25-50	10-35	20-30	NP-5
	20-60	Extremely cobbly sand, extremely gravelly sand, extremely gravelly loamy sand.	GP, GP-GM	A-1	40-65	20-50	10-40	5-25	0-10	---	NP
80, 81----------- Mikesell	0-8	Clay loam--------	CL	A-6	0-5	85-100	80-100	70-90	55-75	30-40	10-15
	8-60	Clay, shaly clay	CL, CH	A-7	0-5	75-100	70-100	65-95	55-90	40-60	20-30
82--------------- Musselshell	0-8	Loam-------------	CL-ML	A-4	0-10	90-100	85-100	60-80	55-75	25-30	5-10
	8-25	Loam, gravelly loam.	CL-ML, GM-GC, SM-SC	A-4	0-10	60-100	55-100	50-80	40-75	25-30	5-10
	25-41	Gravelly loam, loam, very gravelly loam.	CL-ML, GM, GM-GC, ML	A-4, A-2	0-15	55-100	50-100	40-85	30-65	15-25	NP-10
	41-60	Very gravelly sandy loam, very gravelly fine sandy loam, very gravelly loam.	GM-GC, GM	A-2, A-1	10-15	40-60	30-55	25-45	10-30	15-25	NP-10
83--------------- Musselshell	0-8	Gravelly loam----	CL-ML, GM-GC, SM-SC	A-4	5-15	65-85	60-80	45-65	40-60	25-30	5-10
	8-25	Loam, gravelly loam.	CL-ML, GM-GC, SM-SC	A-4	0-10	60-100	55-100	50-80	40-75	25-30	5-10
	25-50	Gravelly loam, loam, very gravelly sandy loam.	CL-ML, GM, GM-GC, ML	A-4, A-2	0-15	55-100	50-100	40-85	30-70	15-25	NP-10
	50-60	Very gravelly sandy loam, very gravelly fine sandy loam, very gravelly loamy sand.	GM-GC, GM	A-2, A-1	10-15	40-60	30-55	25-45	10-30	15-25	NP-10
84*:											
Musselshell-----	0-8	Gravelly loam----	CL-ML, GM-GC, SM-SC	A-4	5-15	65-85	60-80	45-65	40-60	25-30	5-10
	8-25	Gravelly loam, loam.	CL-ML, GM, GM-GC, ML	A-4	0-15	65-100	60-100	45-80	40-70	15-25	NP-10
	25-60	Very gravelly sandy loam, very gravelly fine sandy loam, very gravelly loam.	GM-GC, GM	A-2, A-1	10-15	40-60	30-55	25-45	10-30	15-25	NP-10

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
84*:											
Amesha----------	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	70-90	55-75	25-35	5-15
	8-35	Loam, sandy loam, silt loam.	ML, CL-ML	A-4	0-5	95-100	90-100	70-90	55-75	15-25	NP-10
	35-52	Loam, fine sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0-5	85-100	80-100	65-85	45-65	15-25	NP-10
	52	Weathered bedrock	---	---	---	---	---	---	---	---	---
85*:											
Musselshell-----	0-8	Loam-------------	CL-ML	A-4	0-10	90-100	85-100	60-80	55-75	25-30	5-10
	8-25	Loam, gravelly loam.	CL-ML, GM-GC, SM-SC	A-4	0-10	60-100	55-100	50-80	40-75	25-30	5-10
	25-50	Gravelly loam, loam, very gravelly sandy loam.	CL-ML, GM, GM-GC, ML	A-4, A-2	0-15	55-100	50-100	40-85	30-70	15-25	NP-10
	50-60	Very gravelly sandy loam, very gravelly fine sandy loam, very gravelly loamy sand.	GM-GC, GM	A-2, A-1	10-15	40-60	30-55	25-45	10-30	15-25	NP-10
Cragc-----------	0-4	Gravelly loam----	GM-GC, GM, CL-ML, SM-SC	A-4	0-10	60-75	55-70	50-65	35-55	20-30	NP-10
	4-14	Gravelly loam, gravelly clay loam, very gravelly clay loam.	GC, GM-GC	A-2, A-4, A-6	0-15	30-65	25-60	20-55	15-45	25-35	5-15
	14-32	Extremely gravelly loam, very gravelly clay loam, very gravelly sandy loam.	GM, GM-GC, GP-GM	A-1, A-2	0-15	25-45	15-35	10-25	5-20	20-30	NP-10
	32-60	Extremely gravelly loamy sand, extremely gravelly sandy loam, very gravelly sandy loam.	GP, GP-GM, GM	A-1	0-15	30-50	15-35	5-20	0-15	15-25	NP-5
86--------------- Neen	0-9	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	9-32	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	32-60	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	100	95-100	80-95	25-40	10-20
87--------------- Neen	0-7	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	7-32	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	32-60	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	100	95-100	80-95	25-40	10-20

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
88--------------- Neen	0-9	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	9-32	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	32-60	Silty clay loam, clay loam.	CL	A-6	0	100	100	95-100	80-95	25-40	10-20
89--------------- Nuley	0-7	Sandy loam-------	SM, SM-SC	A-4, A-2	0	80-100	75-95	45-65	25-50	20-30	NP-10
	7-11	Clay loam, sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	80-100	75-95	50-75	40-65	25-40	5-15
	11-24	Sandy loam, loam, gravelly sandy loam.	SM, ML	A-4, A-2	0	75-100	70-95	40-70	30-60	15-25	NP-5
	24-42	Gravelly coarse sand, gravelly loamy coarse sand.	SM, SP-SM	A-1	0-5	60-75	50-65	5-40	5-25	---	NP
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
90--------------- Nuley	0-7	Clay loam--------	CL	A-6	0	80-100	75-95	55-75	50-70	30-40	10-15
	7-15	Clay loam, sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	80-100	75-95	50-75	40-65	25-40	5-15
	15-24	Sandy loam, loam, gravelly sandy loam.	SM, ML	A-4, A-2	0	75-100	70-95	40-70	30-60	15-25	NP-5
	24-50	Gravelly coarse sand, gravelly loamy coarse sand.	SM, SP-SM	A-1	0-5	60-75	50-65	5-40	5-25	---	NP
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
91*:											
Nuley-----------	0-4	Sandy loam-------	SM, SM-SC	A-4, A-2	0	80-100	75-95	45-65	25-50	20-30	NP-10
	4-11	Clay loam, sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	80-100	75-95	50-75	40-65	25-40	5-15
	11-24	Sandy loam, loam, gravelly sandy loam.	SM, ML	A-4, A-2	0	75-100	70-95	40-70	30-60	15-25	NP-5
	24-42	Gravelly coarse sand, gravelly loamy coarse sand.	SM, SP-SM	A-1	0-5	60-75	50-65	5-40	5-25	---	NP
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
92--------------- Oro Fino	0-10	Loam-------------	ML, CL-ML	A-4	0	80-90	75-85	65-80	50-70	20-30	NP-10
	10-22	Gravelly sandy clay loam, gravelly loam, gravelly clay loam.	SM-SC, SC, GM-GC, CL	A-4, A-6, A-2	0	65-80	50-75	40-70	25-55	25-35	5-15
	22-42	Gravelly loam, very gravelly sandy loam, gravelly coarse sandy loam.	SM, GM	A-2, A-1, A-4	0	45-80	40-75	25-60	15-45	15-25	NP-5
	42-60	Very gravelly loamy sand, very gravelly sand.	GM, GP, GP-GM, SP-SM	A-1	0	35-65	25-55	10-40	0-15	---	NP

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
93*, 94*:											
Oro Fino--------	0-10	Gravelly loam----	ML, CL-ML, SM, GM	A-4	0	60-80	55-75	50-70	40-60	20-30	NP-10
	10-22	Gravelly sandy clay loam, gravelly loam, gravelly clay loam.	SM-SC, SC, GM-GC, CL	A-4, A-6, A-2	0	65-80	50-75	40-70	25-55	25-35	5-15
	22-42	Gravelly loam, very gravelly sandy loam, gravelly coarse sandy loam.	SM, GM	A-2, A-1, A-4	0	45-80	40-75	25-60	15-45	15-25	NP-5
	42-60	Very gravelly loamy sand, very gravelly sand.	GM, GP, GP-GM, SP-SM	A-1	0	35-65	25-55	10-40	0-15	---	NP
Poin------------	0-5	Very flaggy sandy loam.	GM, SM	A-1, A-2	30-45	50-75	40-65	30-55	15-35	15-25	NP-5
	5-12	Very channery sandy loam, very flaggy sandy loam, extremely channery sandy loam.	GM, SM	A-1, A-2, A-4	15-30	30-70	25-60	15-50	10-40	15-25	NP-5
	12-19	Extremely channery sandy loam, extremely flaggy sandy loam.	GM, GP, GP-GM	A-1	25-40	15-45	10-35	5-30	0-20	15-25	NP-5
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
95*:											
Pensore---------	0-4	Very channery loam.	GM, GM-GC	A-1, A-2	0-10	40-60	30-50	20-45	20-35	20-30	NP-10
	4-16	Very channery loam.	GM, GM-GC	A-1, A-2	5-10	40-65	35-55	20-45	20-35	20-30	NP-10
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Crago-----------	0-4	Very stony loam	ML, CL-ML, SM, GM	A-4	15-30	65-85	60-80	50-70	40-60	20-30	NP-10
	4-15	Very stony loam, very cobbly clay loam, gravelly loam.	GM-GC, GC, SM-SC, CL	A-4, A-6, A-2	10-45	50-80	45-75	40-70	30-60	25-35	5-15
	15-60	Very cobbly loam, extremely cobbly sandy loam, very gravelly clay loam.	GM, GM-GC	A-2, A-1	25-55	30-50	25-45	20-40	15-35	20-30	NP-10
Rock outcrop.											
96*.											
Pits											

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
97*:											
Poin------------	0-7	Very flaggy sandy loam.	GM, SM	A-1, A-2	30-45	50-75	40-65	30-55	15-35	15-25	NP-5
	7-14	Extremely channery sandy loam, extremely flaggy sandy loam.	GM, GP, GP-GM	A-1	25-40	15-45	10-35	5-30	0-20	15-25	NP-5
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Earcree---------	0-28	Gravelly sandy loam.	SM	A-4, A-2	0-10	65-85	55-75	40-60	25-45	20-25	NP-5
	28-60	Very gravelly loamy coarse sand, gravelly sandy loam, coarse sandy loam.	SM, GM	A-1, A-2	0-15	45-95	40-90	20-50	10-35	15-25	NP-5
98*:											
Poin------------	0-5	Very flaggy sandy loam.	GM, SM	A-1, A-2	30-45	50-75	40-65	30-55	15-35	15-25	NP-5
	5-12	Very channery sandy loam, very flaggy sandy loam, extremely channery sandy loam.	GM, SM	A-1, A-2, A-4	15-30	30-70	25-60	15-50	10-40	15-25	NP-5
	12-19	Extremely channery sandy loam, extremely flaggy sandy loam.	GM, GP, GP-GM	A-1	25-40	15-45	10-35	5-30	0-20	15-25	NP-5
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
99*:											
Poin------------	0-7	Very flaggy sandy loam.	GM, SM	A-1, A-2	30-45	50-75	40-65	30-55	15-35	15-25	NP-5
	7-14	Extremely channery sandy loam, extremely flaggy sandy loam.	GM, GP, GP-GM	A-1	25-40	15-45	10-35	5-30	0-20	15-25	NP-5
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Sebud-----------	0-14	Very channery sandy loam.	GM, SM	A-2, A-4	15-25	45-70	35-60	30-55	25-45	20-30	NP-5
	14-46	Very stony clay loam, very stony sandy clay loam, very stony sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	40-60	75-95	60-85	50-85	40-70	25-40	5-15
	46-60	Very stony coarse sandy loam, very stony sandy clay loam, very stony sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	40-60	75-95	60-85	45-80	35-60	25-40	5-15

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
100-------------- Raynesford	0-16	Loam------------	ML, CL-ML	A-4	0-5	85-100	80-100	70-90	50-75	20-30	NP-10
	16-20	Clay loam, loam, gravelly silt loam.	CL-ML, CL, SM, GM	A-4, A-6	0-15	70-100	60-100	50-90	40-80	20-35	NP-15
	20-60	Gravelly clay loam, gravelly silty clay loam, very gravelly loam.	GM, GM-GC, CL, CL-ML	A-4, A-2, A-6	10-30	40-80	35-75	30-70	25-60	20-35	NP-15
101*:											
Redchief Variant	0-6	Loam------------	CL-ML	A-4	0-5	85-100	80-100	70-90	50-70	25-30	5-10
	6-12	Gravelly loam----	GM-GC, CL-ML, SM-SC	A-4, A-2	0-5	60-80	55-75	45-70	30-60	25-30	5-10
	12-20	Cobbly sandy clay loam, gravelly clay loam.	GC, SC	A-6, A-2	5-15	65-80	60-75	50-70	30-50	30-35	10-15
	20-45	Very gravelly clay, very gravelly clay loam.	GC	A-7, A-6, A-2	0-5	50-70	35-50	30-50	25-50	35-50	15-25
	45-60	Very gravelly clay loam.	GC	A-2, A-6	0-5	50-70	35-50	30-50	25-40	30-40	10-20
Hapgood---------	0-22	Gravelly loam----	SM-SC, CL-ML, GM-GC	A-4	0-15	65-90	60-80	50-75	35-60	25-30	5-10
	22-60	Very gravelly loam, very gravelly clay loam.	GM-GC, GC	A-4, A-2, A-6	15-25	45-70	35-60	25-50	20-45	25-35	5-15
102-------------- Rentsac	0-4	Very channery loam.	SM, GM	A-2, A-1	15-25	45-70	35-60	25-45	15-35	20-25	NP-5
	4-16	Very channery loam, very gravelly loam, very flaggy sandy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	20-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
103*:											
Rentsac---------	0-4	Channery sandy loam.	SM, ML, GM	A-4	0-15	70-85	60-75	45-65	35-55	20-25	NP-5
	4-16	Very channery sandy loam, very channery loam, very flaggy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	20-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Kalsted---------	0-4	Sandy loam-------	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5
	4-60	Sandy loam-------	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
104*:											
Rentsac	0-4	Channery loam	SM, ML, GM	A-4	0-15	70-85	60-75	45-65	35-55	20-25	NP-5
	4-16	Very channery loam, very gravelly sandy loam, very flaggy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	20-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Varney	0-3	Gravelly clay loam.	CL-ML, SM-SC, GM-GC, CL	A-4, A-6	0-10	65-90	55-80	45-75	40-65	25-35	5-15
	3-11	Gravelly clay loam, gravelly sandy clay loam, clay loam.	SC, GC, CL	A-6, A-2	0-10	65-100	55-95	45-85	30-70	30-40	10-20
	11-60	Gravelly sandy loam, loam, gravelly sandy clay loam.	GM-GC, SM-SC, CL-ML, CL	A-2, A-4, A-6	0-10	65-100	55-95	40-80	30-65	20-35	5-15
105 Rivra	0-12	Very gravelly sandy loam.	GM	A-1	10-30	40-60	35-55	20-40	10-20	20-25	NP-5
	12-60	Very gravelly sand, extremely gravelly coarse sand, very gravelly loamy sand.	GP, GP-GM	A-1	15-30	25-55	15-45	5-25	0-10	---	NP
106*:											
Rivra	0-12	Gravelly sandy loam.	SM	A-1, A-2	0-15	65-80	60-75	40-60	20-35	20-25	NP-5
	12-60	Very gravelly loamy sand, extremely gravelly sand, very gravelly sand.	GP, GP-GM	A-1	15-30	25-55	15-45	5-25	0-10	---	NP
Fluvaquents.											
107*:											
Rivra	0-4	Gravelly sandy loam.	SM	A-1, A-2	0-15	65-80	60-75	40-60	20-35	20-25	NP-5
	4-60	Very gravelly sand, extremely gravelly sand, very gravelly loamy sand.	GP, GP-GM	A-1	15-30	25-55	15-45	5-25	0-10	---	NP
Ryell	0-7	Loam	ML, CL-ML	A-4	0	100	100	85-95	55-70	20-30	NP-10
	7-23	Fine sandy loam, silt loam, loam.	ML	A-4	0	100	95-100	85-95	60-85	25-35	NP-5
	23-60	Extremely gravelly loamy sand, very gravelly sand, extremely gravelly sand.	GP-GM, GP	A-1	0-5	30-45	20-35	10-25	0-10	---	NP

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
107*:											
Havre-----------	0-9	Loam-------------	CL-ML	A-4	0	100	100	80-95	60-90	20-30	5-10
	9-60	Stratified fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	100	100	70-95	60-80	20-35	5-15
108*:											
Rochester-------	0-3	Very stony loamy sand.	SM, GM, SP-SM, GP-GM	A-1	25-40	45-70	40-65	20-50	5-20	---	NP
	3-14	Very stony loamy sand, extremely stony loamy sand.	SM, GM, SP-SM, GP-GM	A-1, A-2	30-55	40-75	35-70	20-55	5-20	---	NP
	14-60	Very stony loamy sand, very cobbly loamy sand, extremely stony loamy sand.	GP-GM, GM, SP-SM, SM	A-1	45-55	40-60	35-55	20-40	5-15	---	NP
Rock outcrop.											
109*:											
Rock outcrop.											
Cryoborolls.											
Cryochrepts.											
110*:											
Ryell-----------	0-7	Loam-------------	ML, CL-ML	A-4	0	100	100	85-95	55-70	20-30	NP-10
	7-23	Loam, fine sandy loam, silt loam.	ML	A-4	0	100	95-100	85-95	60-85	25-35	NP-5
	23-60	Extremely gravelly loamy sand, very gravelly sand, extremely gravelly sand.	GP-GM, GP	A-1	0-5	30-45	20-35	10-25	0-10	---	NP
Rivra-----------	0-5	Gravelly sandy loam.	SM	A-1, A-2	0-15	65-80	60-75	40-60	20-35	20-25	NP-5
	5-60	Very gravelly sand, extremely gravelly coarse sand, very gravelly loamy sand.	GP, GP-GM	A-1	15-30	25-55	15-45	5-25	0-10	---	NP
111*:											
Ryell-----------	0-6	Sandy loam-------	SM, ML	A-4	0	100	100	70-85	40-55	---	NP
	6-28	Stratified fine sandy loam to silt loam.	ML, CL-ML	A-4	0	100	95-100	85-95	50-65	20-30	NP-10
	28-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly loamy sand.	GP-GM, GP	A-1	0-5	30-45	20-35	10-25	0-10	---	NP

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
111*:											
Rivra-----------	0-6	Sandy loam-------	SM	A-2, A-4	0	85-100	75-100	50-70	25-40	---	NP
	6-13	Gravelly sandy loam.	SM	A-1, A-2	0-5	60-85	55-75	30-60	15-30	---	NP
	13-60	Very gravelly sand, extremely gravelly sand, extremely gravelly loamy sand.	GP-GM, SP-SM, GP, SP	A-1	0-15	25-60	15-50	10-35	0-10	---	NP
112, 113--------- Saunders	0-5	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-35	10-20
	5-32	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-40	10-20
	32-60	Silty clay, clay, clay loam.	CL	A-7, A-6	0	100	100	95-100	85-95	35-50	15-30
114-------------- Scravo	0-7	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	90-100	50-70	25-40	20-30	NP-10
	7-16	Very gravelly sandy loam, gravelly sandy loam.	SM, GM	A-1	0-5	40-70	30-60	20-40	10-25	15-25	NP-5
	16-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly sand.	GP, GP-GM	A-1	0-5	20-35	15-30	5-20	0-10	---	NP
115-------------- Scravo	0-5	Very cobbly sandy loam.	GM-GC, SM-SC	A-2, A-4	35-45	55-75	50-70	35-65	20-45	20-30	5-10
	5-9	Very gravelly sandy loam, extremely gravelly sandy loam.	GM, SM	A-1	10-25	35-60	30-55	20-35	10-20	15-25	NP-5
	9-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly sand.	GP, GP-GM, GM, SP-SM	A-1	10-25	35-60	30-55	15-35	0-15	---	NP
116*:											
Scravo----------	0-5	Very cobbly sandy loam.	GM-GC, SM-SC	A-2, A-4	35-45	55-75	50-70	35-65	20-45	20-30	5-10
	5-17	Very gravelly sandy loam, extremely gravelly sandy loam.	GM, SM	A-1	10-25	35-60	30-55	20-35	10-20	15-25	NP-5
	17-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly sand.	GP, GP-GM, GM, SP-SM	A-1	10-25	35-60	30-55	15-35	0-15	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
116*:											
Crago	0-7	Loam	CL-ML	A-4	0-5	85-100	80-100	70-95	50-75	20-30	5-10
	7-14	Gravelly loam, gravelly clay loam, very gravelly clay loam.	GM, GM-GC	A-4, A-6, A-2	0-15	30-65	25-60	20-55	15-45	25-35	5-15
	14-32	Extremely gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM, GM-GC, GP-GM	A-1, A-2	0-15	25-45	15-35	10-25	5-20	20-30	NP-10
	32-60	Extremely gravelly loamy sand, extremely gravelly sandy loam, very gravelly sandy loam.	GP, GP-GM, GM	A-1	0-15	30-50	15-35	5-20	0-15	15-25	NP-5
117*:											
Scravo	0-5	Cobbly sandy loam	SM, SM-SC	A-2	15-25	80-85	75-80	40-55	25-30	15-25	NP-10
	5-17	Very gravelly sandy loam, extremely gravelly sandy loam.	GM, SM	A-1	10-25	35-60	30-55	20-35	10-20	15-25	NP-5
	17-60	Very gravelly loamy sand, very gravelly sand, extremely gravelly sand.	GP, GP-GM, GM, SP-SM	A-1	10-25	35-60	30-55	15-35	0-15	---	NP
Thess	0-7	Loam	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-95	60-75	20-35	5-15
	7-30	Loam, silt loam, gravelly loam.	CL-ML, CL, GM-GC, SM-SC	A-4, A-6	0-10	65-100	60-95	55-90	40-75	20-35	5-15
	30-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly sand.	GP, GP-GM	A-1	0-15	20-35	15-30	10-20	0-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
118*:											
Sebud-----------	0-14	Very stony loam	ML, SM, CL-ML, SM-SC	A-4	15-40	75-95	60-85	50-80	35-65	20-30	NP-10
	14-30	Very stony clay loam, very stony sandy clay loam, very stony sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	40-60	75-95	60-85	50-80	40-70	25-40	5-15
	30-46	Very stony clay loam, very stony sandy clay loam, very stony coarse sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	40-60	75-95	60-85	50-85	40-70	25-40	5-15
	46-60	Very stony sandy clay loam, very stony coarse sandy loam, very stony clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	40-60	75-95	60-85	45-75	35-60	25-40	5-15
Hapgood---------	0-18	Gravelly loam----	SM-SC, CL-ML, GM-GC	A-4	0-15	65-90	60-80	50-75	35-60	25-30	5-10
	18-60	Very gravelly loam, very gravelly clay loam.	GM-GC, GC	A-4, A-2, A-6	15-25	45-70	35-60	25-50	20-45	25-35	5-15
119*:											
Sebud-----------	0-14	Very flaggy loam	GM, SM, GM-GC SM-SC	A-4, A-2	25-40	50-75	40-65	35-60	25-50	20-30	NP-10
	14-30	Very stony clay loam, very stony sandy clay loam, very stony sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	40-60	75-95	60-85	50-80	40-70	25-40	5-15
	30-46	Very stony clay loam, very stony sandy clay loam, very stony coarse sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	40-60	75-95	60-85	50-85	40-70	25-40	5-15
	46-60	Very stony sandy clay loam, very stony coarse sandy loam, very stony clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	40-60	75-95	60-85	45-75	35-60	25-40	5-15
Hapgood---------	0-18	Gravelly loam----	SM-SC, CL-ML, GM-GC	A-4	0-15	65-90	60-80	50-75	35-60	25-30	5-10
	18-60	Very gravelly loam, very gravelly clay loam.	GM-GC, GC	A-4, A-2, A-6	15-25	45-70	35-60	25-50	20-45	25-35	5-15
Rock outcrop.											

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
120*:											
Sebud-----------	0-8	Very gravelly sandy loam.	GM, SM	A-2, A-4	15-25	45-70	35-60	30-55	25-45	20-30	NP-5
	8-23	Very channery clay loam, very stony sandy clay loam, very stony sandy loam.	GM-GC, GC	A-2	15-30	40-65	35-60	30-55	10-35	25-40	5-15
	23-60	Very stony clay loam, very stony sandy clay loam, very stony sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	40-60	75-95	60-85	45-80	35-60	25-40	5-15
Rochester-------	0-17	Very stony loamy sand.	SM, GM, SP-SM, GP-GM	A-1	25-40	45-70	40-65	20-50	5-20	---	NP
	17-60	Very stony loamy sand, very gravelly loamy sand.	SM, GM, SP-SM, GP-GM	A-1, A-2	15-40	50-75	40-65	20-50	5-20	---	NP
Rock outcrop.											
121-------------- Shadow	0-10	Very channery loam.	GM	A-1, A-2	0-15	40-60	30-50	25-40	15-30	20-25	NP-5
	10-30	Very channery sandy loam, extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1	0-15	30-55	20-45	10-30	5-20	20-25	NP-5
	30-60	Extremely channery sandy loam, extremely channery loam.	GP, GP-GM	A-1	0-15	20-35	10-25	5-20	0-10	20-25	NP-5
122-------------- Shadow	0-6	Very flaggy loam	GM	A-1, A-2, A-4	30-40	45-75	40-70	35-65	25-50	20-25	NP-5
	6-17	Very channery sandy loam, extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1	0-15	30-55	20-45	10-30	5-20	20-25	NP-5
	17-60	Extremely channery sandy loam, extremely channery loam.	GP-GM	A-1	0-15	25-35	15-25	10-20	5-10	20-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
123*:											
Shadow very channery sandy loam-----------	0-17	Very channery sandy loam.	GM	A-1, A-2	0-15	40-60	30-50	25-40	15-30	20-25	NP-5
	17-30	Very channery sandy loam, extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1	0-15	30-55	20-45	10-30	5-20	20-25	NP-5
	30-60	Extremely channery sandy loam, extremely channery loam.	GP-GM	A-1	0-15	25-35	15-25	10-20	5-10	20-25	NP-5
Shadow stony loam-----------	0-10	Stony loam-------	GM	A-1, A-2, A-4	15-40	45-65	40-60	35-55	25-45	20-25	NP-5
	10-30	Very channery sandy loam, extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1	0-15	30-55	20-45	10-30	5-20	20-25	NP-5
	30-60	Extremely channery sandy loam, extremely channery loam.	GP-GM	A-1	0-15	25-35	15-25	10-20	5-10	20-25	NP-5
124*:											
Shadow very channery sandy loam-----------	0-9	Very channery sandy loam.	GM	A-1, A-2	0-15	40-60	30-50	25-40	15-30	20-25	NP-5
	9-30	Very channery sandy loam, extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1	0-15	30-55	20-45	10-30	5-20	20-25	NP-5
	30-60	Extremely channery sandy loam, extremely channery loam.	GP-GM	A-1	0-15	25-35	15-25	10-20	5-10	20-25	NP-5
Shadow stony loam-----------	0-10	Stony loam-------	GM	A-1, A-2, A-4	15-40	45-65	40-60	35-55	25-45	20-25	NP-5
	10-30	Very channery sandy loam, extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1	0-15	30-55	20-45	10-30	5-20	20-25	NP-5
	30-60	Extremely channery sandy loam, extremely channery loam.	GP-GM	A-1	0-15	25-35	15-25	10-20	5-10	20-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
125*:											
Shadow----------	0-17	Channery loam----	GM, ML, SM	A-4	0-10	60-80	55-75	45-70	35-60	20-25	NP-5
	17-30	Very channery sandy loam, extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1	0-15	30-55	20-45	10-30	5-20	20-25	NP-5
	30-60	Extremely channery sandy loam, extremely channery loam.	GP-GM	A-1	0-15	25-35	15-25	10-20	5-10	20-25	NP-5
Mikesell--------	0-8	Clay loam--------	CL	A-6	0-5	85-100	80-100	70-90	55-75	30-40	10-15
	8-60	Shaly clay, clay	CL, CH	A-7	0-5	75-100	70-100	65-95	55-90	40-60	20-30
Worock----------	0-12	Gravelly loam----	CL-ML, GM-GC	A-4	0-5	60-80	55-75	45-70	35-60	20-30	5-10
	12-24	Gravelly loam, gravelly clay loam, gravelly sandy loam.	CL-ML, GM-GC, SM-SC	A-4, A-2	5-15	65-80	60-75	50-70	30-55	25-30	5-10
	24-60	Very gravelly loam, very gravelly clay loam, very cobbly sandy clay loam.	GC, SC	A-2, A-6	30-45	45-75	40-70	35-65	20-40	30-35	10-15
126------------- Shedhorn	0-12	Clay loam--------	CL	A-6	0-5	85-100	80-100	70-95	60-80	30-40	10-20
	12-40	Clay loam, clay, channery clay loam.	CL, SC, GC	A-6, A-7	0-10	65-100	55-95	50-95	45-80	35-50	15-25
	40-60	Clay loam, shaly clay loam, shaly clay.	CL, SC, GC	A-6, A-7	0-10	65-95	55-85	50-80	40-70	35-50	15-25
127*:											
Shedhorn--------	0-12	Clay loam--------	CL	A-6	0-5	85-100	80-100	70-95	60-80	30-40	10-20
	12-40	Clay loam, clay, channery clay loam.	CL, SC, GC	A-6, A-7	0-10	65-100	55-95	50-95	45-80	35-50	15-25
	40-60	Clay loam, shaly clay loam, shaly clay.	CL, SC, GC	A-6, A-7	0-10	65-95	55-85	50-80	40-70	35-50	15-25
Garlet----------	0-15	Very flaggy loam	GM, GM-GC	A-4, A-2	25-45	45-70	40-65	35-60	25-50	20-30	NP-10
	15-26	Extremely cobbly loam, very flaggy loam, very channery sandy loam.	GM, GM-GC	A-1, A-2	15-50	35-65	30-60	25-50	15-35	20-30	NP-10
	26-60	Extremely cobbly sandy clay loam, very flaggy loam, very channery sandy loam.	GM, GM-GC	A-1, A-2	25-55	25-60	20-55	15-45	10-30	20-30	NP-10
Rock outcrop.											

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
128*:											
Shedhorn	0-12	Clay loam	CL	A-6	0-5	85-100	80-100	70-95	60-80	30-40	10-20
	12-40	Clay loam, clay, channery clay loam.	CL, SC, GC	A-6, A-7	0-10	65-100	55-95	50-95	45-80	35-50	15-25
	40-60	Clay loam, shaly clay loam, shaly clay.	CL, SC, GC	A-6, A-7	0-10	65-95	55-85	50-80	40-70	35-50	15-25
Rock outcrop.											
129*:											
Shurley	0-4	Very flaggy coarse sandy loam.	SM, GM	A-2, A-1	30-45	50-70	40-60	15-40	10-35	15-25	NP-5
	4-10	Very flaggy coarse sandy loam.	SM, GM	A-2, A-1	30-45	50-70	40-60	15-40	10-35	15-25	NP-5
	10-60	Very flaggy loamy coarse sand, extremely flaggy loamy sand.	GP, GP-GM, SM, SP-SM	A-1	30-55	30-70	15-60	5-40	0-20	---	NP
Rentsac	0-4	Channery sandy loam.	SM, ML, GM	A-4	0-15	70-85	60-75	45-65	35-55	20-25	NP-5
	4-12	Very channery sandy loam, very channery loam, very flaggy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	20-25	NP-5
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
130*:											
Shurley	0-4	Very flaggy coarse sandy loam.	SM, GM	A-2, A-1	30-45	50-70	40-60	15-40	10-35	15-25	NP-5
	4-10	Very flaggy coarse sandy loam.	SM, GM	A-2, A-1	30-45	50-70	40-60	15-40	10-35	15-25	NP-5
	10-60	Very flaggy loamy coarse sand, extremely flaggy loamy sand.	GP, GP-GM, SM, SP-SM	A-1	30-55	30-70	15-60	5-40	0-20	---	NP
Rock outcrop.											
131 Thess	0-7	Sandy loam	SM, SM-SC	A-2, A-4	0	95-100	85-100	50-70	25-40	15-25	NP-10
	7-30	Loam, silt loam, gravelly loam.	CL-ML, CL, GM-GC, SM-SC	A-4, A-6	0-10	65-100	60-95	55-90	40-75	20-35	5-15
	30-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly sand.	GP, GP-GM	A-1	0-15	20-35	15-30	10-20	0-10	---	NP

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
132-------------- Thess	0-7	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-95	60-75	20-35	5-15
	7-30	Loam, silt loam, gravelly loam.	CL-ML, CL, GM-GC, SM-SC	A-4, A-6	0-10	65-100	60-95	55-90	40-75	20-35	5-15
	30-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly sand.	GP, GP-GM	A-1	0-15	20-35	15-30	10-20	0-10	---	NP
133*:											
Thess-----------	0-7	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-95	60-75	20-35	5-15
	7-30	Loam, silt loam, gravelly loam.	CL-ML, CL, GM-GC, SM-SC	A-4, A-6	0-10	65-100	60-95	55-90	40-75	20-35	5-15
	30-60	Very gravelly sand, very gravelly loamy sand, extremely gravelly sand.	GP, GP-GM	A-1	0-15	20-35	15-30	10-20	0-10	---	NP
Amesha----------	0-7	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	70-90	55-75	25-35	5-15
	7-50	Loam, sandy loam, silt loam.	ML, CL-ML	A-4	0-5	95-100	90-100	70-90	55-75	20-30	NP-10
	50-60	Loam, fine sandy loam, gravelly sandy loam.	ML, CL-ML, SM, SM-SC	A-4, A-2	0-10	65-100	55-100	45-85	25-65	20-30	NP-10
134-------------- Tiban	0-8	Cobbly loam------	CL-ML, SM-SC	A-4	15-30	75-100	70-90	60-80	45-70	20-30	5-10
	8-14	Gravelly clay loam, cobbly loam, very stony loam.	GM-GC, GC, SM-SC, CL-ML	A-4, A-6, A-2	10-30	50-85	45-80	40-70	30-55	20-35	5-15
	14-60	Very gravelly clay loam, very cobbly loam, very stony loam.	GM-GC, GC, SM-SC, SC	A-4, A-6, A-2	25-30	40-70	35-65	30-60	25-50	20-35	5-15
135-------------- Tiban	0-4	Very stony loam	CL-ML, SM-SC, GM-GC	A-4	25-45	60-85	55-80	45-70	35-60	20-30	5-10
	4-14	Gravelly clay loam, cobbly loam, very stony loam.	GM-GC, GC, SM-SC, CL-ML	A-4, A-6, A-2	10-30	50-85	45-80	40-70	30-55	20-35	5-15
	14-60	Very gravelly clay loam, very cobbly loam, very stony loam.	GM-GC, GC, SM-SC, SC	A-4, A-6, A-2	25-30	40-70	35-65	30-60	25-50	20-35	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
136*:											
Tiban	0-7	Very stony loam	CL-ML, SM-SC, GM-GC	A-4	25-45	60-85	55-80	45-70	35-60	20-30	5-10
	7-22	Gravelly clay loam, very gravelly loam, very stony loam.	GM-GC, GC, SM-SC, CL-ML	A-4, A-6, A-2	10-30	50-85	45-80	40-70	30-55	20-35	5-15
	22-60	Very gravelly clay loam, very cobbly loam, very stony loam.	GM-GC, GC, SM-SC, SC	A-4, A-6, A-2	25-30	40-70	35-65	30-60	25-50	20-35	5-15
Rock outcrop.											
137 Tineman	0-7	Gravelly loam	ML, CL-ML, SM, GM	A-4	0-15	65-80	60-75	50-70	35-60	15-25	NP-10
	7-28	Very gravelly loam, very gravelly sandy clay loam, very cobbly loam.	GM, GM-GC	A-2, A-1, A-4	15-30	40-65	35-60	30-55	20-40	20-30	NP-10
	28-60	Very gravelly loamy sand, very gravelly sand.	GM, GP-GM, SM, SP-SM	A-1	10-25	40-65	30-55	15-40	5-15	---	NP
138*:											
Tineman	0-7	Cobbly loam	ML, CL-ML, SM, SM-SC	A-4	15-30	75-90	70-90	60-85	40-65	15-25	NP-10
	7-21	Very gravelly loam, very gravelly sandy clay loam, very cobbly loam.	GM, GM-GC	A-2, A-1, A-4	15-30	40-65	35-60	30-55	20-40	20-30	NP-10
	21-38	Very cobbly sandy loam, very gravelly loam.	GM	A-2, A-1	15-30	40-65	35-60	25-50	15-35	15-25	NP-5
	38-60	Very gravelly loamy sand, very gravelly sand.	GM, GP-GM, SM, SP-SM	A-1	10-25	40-65	30-55	15-40	5-15	---	NP
Earcree	0-18	Sandy loam	SM	A-2, A-4	0-15	85-100	80-100	40-70	25-40	20-25	NP-5
	18-60	Very gravelly sandy loam, gravelly sandy loam, sandy loam.	SM, GM	A-1, A-2	0-15	45-95	40-90	20-50	10-35	15-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
139, 140--------- Trimad	0-6	Cobbly loam------	CL-ML, SM-SC	A-4	15-25	75-95	70-90	55-80	40-65	20-30	5-10
	6-9	Gravelly loam, gravelly sandy loam, cobbly loam.	GM, SM	A-4	10-25	70-90	65-85	50-60	35-45	15-25	NP-5
	9-18	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM, SM	A-2, A-1, A-4	15-30	45-75	35-65	25-55	20-45	15-25	NP-5
	18-60	Extremely gravelly sandy loam, extremely gravelly loam, very gravelly sandy loam.	GM, SM	A-2, A-1, A-4	15-30	45-75	35-65	25-50	15-40	15-25	NP-5
141-------------- Trimad	0-2	Very stony loam	CL-ML, SM-SC, GM-GC	A-4, A-2	15-30	55-80	50-75	45-70	30-60	20-30	5-10
	2-9	Gravelly loam, gravelly sandy loam, cobbly loam.	GM, SM	A-4	10-25	70-90	65-85	50-60	35-45	15-25	NP-5
	9-18	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM, SM	A-2, A-1, A-4	15-30	45-75	35-65	25-55	20-45	15-25	NP-5
	18-60	Extremely gravelly sandy loam, extremely gravelly loam, very gravelly sandy loam.	GM, SM	A-2, A-1, A-4	15-30	45-75	35-65	25-50	15-40	15-25	NP-5
142*: Trimad----------	0-2	Cobbly loam------	CL-ML, SM-SC	A-4	15-25	75-95	70-90	55-80	40-65	20-30	5-10
	2-9	Gravelly loam, gravelly sandy loam, cobbly loam.	GM, SM	A-4	10-25	70-90	65-85	50-60	35-45	15-25	NP-5
	9-18	Very gravelly loam, very gravelly sandy loam, extremely gravelly loam.	GM, SM	A-2, A-1, A-4	15-30	45-75	35-65	25-55	20-45	15-25	NP-5
	18-60	Extremely gravelly sandy loam, extremely gravelly loam, very gravelly sandy loam.	GM, SM	A-2, A-1, A-4	15-30	45-75	35-65	25-50	15-40	15-25	NP-5
Kalsted---------	0-4	Sandy loam-------	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5
	4-60	Sandy loam-------	SM	A-2, A-4	0	80-100	75-100	45-70	25-40	20-25	NP-5

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
143------------- Trudau	0-7	Loam------------	CL-ML	A-4	0	100	100	85-95	60-75	20-30	5-10
	7-30	Loam, clay loam	CL-ML, CL	A-6, A-4	0	100	100	85-100	60-80	25-40	5-15
	30-60	Stratified clay loam to sandy loam.	CL-ML, ML	A-4	0-10	90-100	85-100	70-100	55-80	25-35	5-10
144------------- Trudau	0-7	Loam------------	CL-ML	A-4	0	100	100	85-95	60-75	20-30	5-10
	7-27	Loam, clay loam	CL-ML, CL	A-6, A-4	0	100	100	85-100	60-80	25-40	5-15
	27-60	Stratified clay loam to sandy loam.	CL-ML, ML	A-4	0-10	90-100	85-100	70-100	55-80	25-35	5-10
145, 146. Ustic Torriorthents											
147, 148--------- Varney	0-5	Clay loam--------	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	60-95	55-85	25-35	5-15
	5-16	Gravelly clay loam, gravelly sandy clay loam, clay loam.	SC, GC, CL	A-6, A-2	0-10	65-100	55-95	45-85	30-70	30-40	10-20
	16-48	Gravelly sandy loam, loam, gravelly sandy clay loam.	GM-GC, SM-SC, CL-ML, CL	A-2, A-4, A-6	0-10	65-100	55-95	40-80	30-65	20-35	5-15
	48-60	Stratified gravelly loamy sand to loam.	SM	A-2, A-1, A-4	0-10	70-100	55-95	35-75	20-50	15-25	NP-5
149------------- Varney	0-5	Cobbly clay loam	CL-ML, CL	A-4, A-6	15-30	75-100	70-90	60-80	50-70	25-35	5-15
	5-16	Cobbly clay loam, channery clay loam, sandy clay loam.	CL, GC, SC	A-6	0-25	70-100	65-95	55-85	40-65	30-40	10-15
	16-48	Gravelly sandy loam, channery loam, sandy clay loam.	CL, GM-GC, SM-SC, CL-ML	A-4, A-6	0-10	60-100	55-95	45-80	35-60	20-35	5-15
	48-60	Stratified gravelly loamy sand to loam.	SM	A-4, A-2	0-10	65-100	55-95	40-80	30-50	15-25	NP-5
150, 151--------- Villy	0-10	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	25-35	10-15
	10-42	Silty clay loam, silt loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	70-95	20-35	5-15
	42-60	Silty clay loam, silt loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	90-100	55-80	20-35	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
152*:											
Whitecow--------	0-9	Extremely channery loam.	GM, GM-GC	A-2, A-1	15-30	20-40	15-30	15-30	10-25	20-30	NP-10
	9-20	Very channery loam, extremely gravelly loam, very cobbly clay loam.	GM-GC, GC	A-2	15-30	20-45	15-40	15-35	10-30	25-35	5-15
	20-60	Extremely channery loam, extremely gravelly loam, extremely cobbly clay loam.	GM-GC, GC, GP-GC	A-2	15-30	20-40	10-30	10-30	5-25	20-35	5-15
Rock outcrop.											
153*:											
Whitore channery loam-----------	0-12	Channery loam----	GM-GC, SM-SC, CL-ML	A-4	0-10	60-80	55-75	45-70	35-60	25-30	5-10
	12-60	Very cobbly clay loam, extremely cobbly loam, very channery loam.	GM-GC, GC	A-4, A-6, A-2	25-55	35-70	30-65	25-65	20-50	25-35	5-15
Whitore stony loam-----------	0-12	Stony loam-------	CL-ML, SM-SC	A-4	15-30	75-95	70-90	60-85	40-70	25-30	5-10
	12-60	Very flaggy loam, very cobbly clay loam, extremely channery loam.	GM-GC, GC	A-4, A-6, A-2	25-40	40-65	30-55	25-50	20-40	25-35	5-15
154*:											
Whitore---------	0-6	Very channery clay loam.	GC	A-6, A-2	10-25	40-60	35-55	30-55	25-45	30-40	10-15
	6-60	Very cobbly clay loam, extremely cobbly loam, very channery clay loam.	GM-GC, GC	A-4, A-6, A-2	25-55	35-70	30-65	25-65	20-50	25-35	5-15
Mikesell--------	0-8	Clay loam--------	CL	A-6	0-5	85-100	80-100	70-90	55-75	30-40	10-15
	8-60	Clay, shaly clay	CL, CH	A-7	0-5	75-100	70-100	65-95	55-90	40-60	20-30
Rock outcrop.											
155*:											
Whitore channery loam-----------	0-12	Channery loam----	GM-GC, SM-SC, CL-ML	A-4	0-10	60-80	55-75	45-70	35-60	25-30	5-10
	12-60	Very cobbly clay loam, extremely cobbly loam, very channery loam.	GM-GC, GC	A-4, A-6, A-2	25-55	35-70	30-65	25-65	20-50	25-35	5-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
155*:											
Whitore stony loam-----------	0-12	Stony loam-------	CL-ML, SM-SC	A-4	15-30	75-95	70-90	60-85	40-70	25-30	5-10
	12-60	Very flaggy loam, very cobbly clay loam, extremely channery loam.	GM-GC, GC	A-4, A-6, A-2	25-40	40-65	30-55	25-50	20-40	25-35	5-15
Rock outcrop.											
156-------------- Woodhall	0-10	Gravelly loam----	CL-ML, SM-SC, GM-GC	A-4	0-5	60-80	55-75	45-70	35-60	20-30	5-10
	10-30	Very gravelly clay loam, very stony loam, very flaggy loam.	GC	A-2, A-6	10-45	45-60	40-55	35-55	30-45	30-40	10-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
157*:											
Woodhall--------	0-10	Stony loam-------	CL-ML, SM-SC, GM-GC	A-4	10-15	70-90	65-85	55-80	40-65	20-30	5-10
	10-30	Very gravelly clay loam, very stony loam, very flaggy loam.	GC	A-2, A-6	10-45	45-60	40-55	35-55	30-45	30-40	10-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Blaine----------	0-6	Stony loam-------	CL-ML	A-4	10-30	85-95	80-95	70-90	50-70	20-30	5-10
	6-10	Very gravelly clay loam, very stony clay loam.	GC	A-6	15-30	55-65	50-60	45-55	35-45	25-40	10-20
	10-25	Very stony loam, extremely stony sandy loam.	GM-GC	A-2, A-4	25-55	30-70	25-65	20-55	15-40	20-30	5-10
	25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hapgood---------	0-18	Gravelly loam----	SM-SC, CL-ML, GM-GC	A-4	0-15	65-90	60-80	50-75	35-60	25-30	5-10
	18-60	Very gravelly loam, very gravelly clay loam.	GM-GC, GC	A-4, A-2, A-6	15-25	45-70	35-60	25-50	20-45	25-35	5-15
158-------------- Worock	0-14	Gravelly sandy loam.	CL-ML, GM-GC	A-4	0-5	60-80	55-75	45-70	35-60	20-30	5-10
	14-60	Very gravelly loam, very gravelly clay loam, very gravelly sandy clay loam.	GC	A-2	15-25	40-50	35-45	30-40	25-35	30-35	10-15

See footnote at end of table.

TABLE 12.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
159*:											
Worock----------	0-18	Very stony loam	GM-GC	A-2, A-4	15-30	55-70	45-60	40-55	25-45	25-30	5-10
	18-52	Very stony clay loam, very gravelly clay loam, very gravelly loam.	GC	A-6, A-2	10-35	50-70	40-60	40-55	25-40	30-40	10-15
	52-60	Very gravelly clay loam, very stony clay loam, very gravelly loam.	GC	A-6, A-2	15-40	50-70	40-60	30-55	25-40	30-40	10-15
Mikesell--------	0-8	Clay loam--------	CL	A-6	0-5	85-100	80-100	70-90	55-75	30-40	10-15
	8-60	Clay, shaly clay	CL, CH	A-7	0-5	75-100	70-100	65-95	55-90	40-60	20-30
160-------------- Yetull	0-8	Loamy sand-------	SM	A-1, A-2, A-4	0-5	95-100	95-100	40-65	15-40	---	NP
	8-60	Loamy coarse sand, sand, loamy sand.	SM, SP-SM	A-1, A-3, A-2	0-5	95-100	95-100	45-70	5-30	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
1, 2------------- Adel	0-23	20-27	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low-------	0.28	5	6	4-8
	23-37	18-30	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.37			
	37-60	18-30	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low-------	0.28			
3---------------- Amesha	0-7	15-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37	5	4L	1-3
	7-60	10-18	0.6-2.0	0.14-0.17	7.9-8.4	<2	Low-------	0.37			
4---------------- Amesha	0-8	15-25	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low-------	0.37	4	4L	1-3
	8-35	10-18	0.6-2.0	0.15-0.19	7.9-8.4	<2	Low-------	0.37			
	35-52	10-18	0.6-2.0	0.13-0.16	7.9-8.4	<2	Low-------	0.37			
	52	---	---	---	---	---	----------	----			
5*:											
Amesha----------	0-8	15-25	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low-------	0.37	4	4L	1-3
	8-35	10-18	0.6-2.0	0.15-0.19	7.9-8.4	<2	Low-------	0.37			
	35-52	10-18	0.6-2.0	0.13-0.16	7.9-8.4	<2	Low-------	0.37			
	52	---	---	---	---	---	----------	----			
Musselshell-----	0-8	20-27	0.6-2.0	0.14-0.18	7.4-8.4	<2	Low-------	0.20	3	4L	1-3
	8-25	10-18	0.6-2.0	0.14-0.18	7.9-9.0	<2	Low-------	0.20			
	25-60	10-18	2.0-6.0	0.06-0.10	7.9-9.0	<2	Low-------	0.05			
6---------------- Amsterdam	0-5	27-30	0.2-0.6	0.18-0.20	6.6-7.3	<2	Moderate	0.32	5	6	2-4
	5-11	18-30	0.2-0.6	0.17-0.20	6.6-7.8	<2	Low-------	0.43			
	11-34	18-30	0.2-0.6	0.17-0.20	7.9-8.4	<4	Low-------	0.43			
	34-60	10-20	0.6-2.0	0.17-0.19	7.9-8.4	<4	Low-------	0.43			
7*:											
Amsterdam-------	0-5	27-30	0.2-0.6	0.18-0.20	6.6-7.3	<2	Moderate	0.32	5	6	2-4
	5-11	18-30	0.2-0.6	0.17-0.20	6.6-7.8	<2	Low-------	0.43			
	11-34	18-30	0.2-0.6	0.17-0.20	7.9-8.4	<4	Low-------	0.43			
	34-60	10-20	0.6-2.0	0.17-0.19	7.9-8.4	<4	Low-------	0.43			
Brocko Variant--	0-5	20-27	0.6-2.0	0.19-0.22	7.9-8.4	<2	Low-------	0.37	5	4L	1-3
	5-23	20-30	0.6-2.0	0.16-0.19	7.9-8.4	<2	Low-------	0.32			
	23-60	20-30	0.6-2.0	0.16-0.19	7.9-8.4	<2	Low-------	0.37			
8*:											
Aquic Cryoboralfs.											
Typic Cryochrepts.											
9*:											
Armitage--------	0-5	15-27	0.6-2.0	0.12-0.15	7.4-7.8	<4	Low-------	0.24	3	5	1-2
	5-7	40-50	0.06-0.2	0.12-0.14	7.9-8.4	4-8	Moderate	0.32			
	7-13	24-32	0.2-0.6	0.13-0.15	7.9-8.4	4-8	Moderate	0.32			
	13-36	17-25	0.6-2.0	0.14-0.17	7.9-8.4	4-8	Low-------	0.37			
	36-60	0-10	>20.0	0.02-0.03	7.9-8.4	<4	Low-------	0.05			
Thess-----------	0-6	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37	3	4L	1-3
	6-30	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37			
	30-60	0-5	>20.0	0.01-0.02	7.4-8.4	<2	Low-------	0.02			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
10---------------	0-4	10-20	0.6-2.0	0.16-0.20	6.1-7.3	<2	Low-------	0.37	3	5	1-3
Attewan	4-8	20-35	0.6-2.0	0.14-0.17	6.6-7.8	<2	Moderate	0.32			
	8-24	15-30	0.6-2.0	0.13-0.15	7.4-8.4	<2	Moderate	0.32			
	24-60	0-10	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
11---------------	0-4	10-20	0.6-2.0	0.16-0.20	6.1-7.3	<2	Low-------	0.37	3	5	1-3
Attewan	4-10	20-35	0.6-2.0	0.14-0.17	6.6-7.8	<2	Moderate	0.32			
	10-35	15-30	0.6-2.0	0.13-0.15	7.4-8.4	<2	Moderate	0.32			
	35-60	0-10	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
12---------------	0-4	10-20	0.6-2.0	0.12-0.14	6.6-7.3	<2	Low-------	0.20	3	5	2-4
Attewan	4-11	20-35	0.6-2.0	0.12-0.15	6.6-7.8	<2	Moderate	0.32			
	11-20	15-30	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low-------	0.32			
	20-60	0-10	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
13---------------	0-5	10-20	0.6-2.0	0.08-0.10	6.6-7.3	<2	Low-------	0.15	3	8	2-4
Attewan	5-9	20-35	0.6-2.0	0.12-0.15	6.6-7.8	<2	Moderate	0.32			
	9-20	15-30	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low-------	0.32			
	20-60	0-10	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
14*. Badland											
15---------------	0-7	10-25	0.6-2.0	0.14-0.16	6.6-7.3	<2	Low-------	0.20	2	5	4-10
Bearmouth	7-15	10-25	0.6-2.0	0.08-0.09	6.6-7.8	<2	Low-------	0.15			
	15-60	0-10	6.0-20	0.02-0.03	6.6-7.8	<2	Low-------	0.02			
16---------------	0-6	15-25	0.6-2.0	0.05-0.06	6.6-7.3	<2	Low-------	0.10	2	8	4-10
Bearmouth	6-20	10-25	0.6-2.0	0.08-0.09	6.6-7.8	<2	Low-------	0.15			
	20-60	0-10	6.0-20	0.02-0.03	6.6-7.8	<2	Low-------	0.02			
17---------------	0-4	10-27	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low-------	0.20	2	5	1-3
Beaverell	4-17	15-35	0.6-2.0	0.06-0.10	6.6-7.8	<2	Moderate	0.10			
	17-60	0-5	>20	0.02-0.04	7.4-8.4	<2	Low-------	0.05			
18*:											
Blackhall-------	0-2	5-15	2.0-6.0	0.12-0.15	7.4-8.4	<2	Low-------	0.20	2	3	1-2
	2-16	5-15	2.0-6.0	0.13-0.16	7.9-8.4	<2	Low-------	0.20			
	16	---	---	---	---	---	----------	----			
Rock outcrop.											
19---------------	0-6	15-25	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low-------	0.24	2	6	2-5
Blaine	6-10	27-35	0.6-2.0	0.08-0.09	7.4-7.8	<2	Moderate	0.10			
	10-25	15-25	0.6-2.0	0.06-0.07	7.4-8.4	<2	Low-------	0.05			
	25	---	---	---	---	---	----------	----			
20. Borohemists											
21---------------	0-4	8-16	0.6-2.0	0.09-0.12	5.6-7.3	<2	Low-------	0.24	2	3	3-6
Branham	4-22	10-18	0.6-2.0	0.06-0.07	6.6-7.8	<2	Low-------	0.15			
	22-30	4-10	2.0-6.0	0.02-0.03	6.6-7.8	<2	Low-------	0.10			
	30	---	---	---	---	---	----------	----			
22*:											
Branham---------	0-4	8-16	0.6-2.0	0.09-0.12	5.6-7.3	<2	Low-------	0.24	2	3	3-6
	4-22	10-18	0.6-2.0	0.06-0.07	6.6-7.8	<2	Low-------	0.15			
	22-30	4-10	2.0-6.0	0.02-0.03	6.6-7.8	<2	Low-------	0.10			
	30	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
22*: Rock outcrop.											
23---------------- Bridger	0-7	27-35	0.6-2.0	0.14-0.18	6.6-7.8	<2	Low--------	0.28	5	6	3-5
	7-17	35-50	0.2-0.6	0.12-0.15	6.6-7.8	<2	Moderate	0.32			
	17-21	20-40	0.2-0.6	0.11-0.14	7.4-8.4	<2	Moderate	0.24			
	21-60	18-35	0.6-2.0	0.09-0.10	7.4-8.4	<2	Low--------	0.15			
24---------------- Bridger	0-7	27-35	0.6-2.0	0.11-0.14	6.6-7.8	<2	Low--------	0.24	5	6	3-5
	7-17	35-50	0.2-0.6	0.12-0.15	6.6-7.8	<2	Moderate	0.28			
	17-21	20-40	0.2-0.6	0.11-0.14	7.4-8.4	<2	Moderate	0.24			
	21-60	18-35	0.6-2.0	0.09-0.11	7.4-8.4	<2	Low--------	0.15			
25*: Bridger---------	0-7	27-35	0.6-2.0	0.11-0.14	6.6-7.8	<2	Low--------	0.24	5	6	3-5
	7-17	35-50	0.2-0.6	0.12-0.15	6.6-7.8	<2	Moderate	0.28			
	17-21	20-40	0.2-0.6	0.11-0.14	7.4-8.4	<2	Moderate	0.24			
	21-60	18-35	0.6-2.0	0.09-0.11	7.4-8.4	<2	Low--------	0.15			
Cryaquolls.											
26*: Bridger---------	0-7	27-35	0.6-2.0	0.11-0.14	6.6-7.8	<2	Low--------	0.24	5	6	3-5
	7-17	35-50	0.2-0.6	0.12-0.15	6.6-7.8	<2	Moderate	0.28			
	17-21	20-40	0.2-0.6	0.11-0.14	7.4-8.4	<2	Moderate	0.24			
	21-60	18-35	0.6-2.0	0.09-0.11	7.4-8.4	<2	Low--------	0.15			
Tiban-----------	0-8	18-27	0.6-2.0	0.11-0.14	6.6-7.3	<2	Low--------	0.20	3	6	3-5
	8-14	18-35	0.6-2.0	0.10-0.13	7.4-8.4	<2	Low--------	0.20			
	14-18	18-35	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low--------	0.15			
	18-60	18-35	0.6-2.0	0.07-0.09	7.4-8.4	<2	Low--------	0.15			
Adel------------	0-23	20-27	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low--------	0.28	5	6	4-8
	23-37	18-30	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low--------	0.37			
	37-60	18-30	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low--------	0.28			
27, 28----------- Brocko	0-8	10-18	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.37	5	4L	1-3
	8-17	10-18	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low--------	0.37			
	17-60	10-18	0.6-2.0	0.16-0.20	7.9-8.4	<2	Low--------	0.37			
29*: Brocko----------	0-4	10-18	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.37	5	4L	1-3
	4-12	10-18	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low--------	0.37			
	12-60	10-18	0.6-2.0	0.16-0.20	7.9-8.4	<2	Low--------	0.37			
Crago-----------	0-4	15-27	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low--------	0.20	3	4L	1-3
	4-14	20-35	0.6-2.0	0.07-0.08	7.4-8.4	<2	Low--------	0.15			
	14-60	15-30	6.0-20	0.03-0.04	7.4-8.4	<2	Low--------	0.10			
30---------------- Brocko Variant	0-5	20-27	0.6-2.0	0.19-0.22	7.9-8.4	<2	Low--------	0.37	5	4L	1-3
	5-23	20-30	0.6-2.0	0.16-0.19	7.9-8.4	<2	Low--------	0.32			
	23-60	20-30	0.6-2.0	0.16-0.19	7.9-8.4	<2	Low--------	0.37			
31---------------- Bullrey	0-21	18-27	0.6-2.0	0.14-0.19	5.6-6.5	<2	Low--------	0.28	3	5	5-8
	21-39	18-27	0.6-2.0	0.10-0.16	5.6-6.5	<2	Low--------	0.24			
	39-48	5-15	0.6-2.0	0.06-0.10	5.6-6.5	<2	Low--------	0.17			
	48	---	---	---	---	---	-----------	----			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
32*:											
Comad-----------	0-17	5-15	6.0-20	0.03-0.05	6.1-7.3	<2	Low-------	0.10	2	8	1-3
	17-42	0-10	6.0-20	0.01-0.03	6.1-7.3	<2	Low-------	0.05			
	42-66	0-10	6.0-20	0.01-0.03	6.1-7.3	<2	Low-------	0.05			
Earcree---------	0-18	10-18	2.0-6.0	0.10-0.13	5.6-7.3	<2	Low-------	0.10	5	3	2-4
	18-63	5-15	2.0-6.0	0.05-0.13	6.1-7.3	<2	Low-------	0.10			
33--------------- Crago	0-4	15-27	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low-------	0.20	3	4L	1-3
	4-14	20-35	0.6-2.0	0.07-0.08	7.4-8.4	<2	Low-------	0.15			
	14-32	18-30	0.6-2.0	0.03-0.04	7.4-8.4	<2	Low-------	0.10			
	32-60	0-20	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
34--------------- Crago	0-4	15-27	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low-------	0.20	3	4L	1-3
	4-14	20-35	0.6-2.0	0.07-0.08	7.4-8.4	<2	Low-------	0.15			
	14-60	15-30	6.0-20	0.03-0.04	7.4-8.4	<2	Low-------	0.10			
35--------------- Crago	0-4	15-27	0.6-2.0	0.11-0.14	7.4-8.4	<2	Low-------	0.17	3	8	1-3
	4-15	20-35	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low-------	0.15			
	15-60	15-30	6.0-20	0.04-0.06	7.4-8.4	<2	Low-------	0.10			
36*:											
Crago-----------	0-4	15-27	0.6-2.0	0.11-0.14	7.4-8.4	<2	Low-------	0.17	3	8	1-3
	4-15	20-35	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low-------	0.15			
	15-60	15-30	6.0-20	0.04-0.06	7.4-8.4	<2	Low-------	0.10			
Kalsted---------	0-4	5-18	2.0-6.0	0.07-0.10	7.4-8.4	<2	Low-------	0.10	5	3	1-2
	4-60	5-15	2.0-6.0	0.07-0.10	7.9-8.4	<2	Low-------	0.17			
Pensore---------	0-4	10-25	0.6-2.0	0.08-0.09	7.9-8.4	<2	Low-------	0.10	1	4L	1-3
	4-16	10-25	0.6-2.0	0.07-0.08	7.9-8.4	<2	Low-------	0.10			
	16	---	---	---	---	---	----------	----			
37*:											
Crago-----------	0-4	15-27	0.6-2.0	0.07-0.08	7.4-8.4	<2	Low-------	0.15	3	4L	1-3
	4-26	20-35	0.6-2.0	0.07-0.08	7.4-8.4	<2	Low-------	0.15			
	26-60	15-27	6.0-20	0.03-0.04	7.4-8.4	<2	Low-------	0.10			
Scravo----------	0-4	10-20	2.0-6.0	0.09-0.11	7.4-7.8	<2	Low-------	0.15	2	3	2-5
	4-14	5-15	2.0-6.0	0.05-0.06	7.9-8.4	<2	Low-------	0.10			
	14-60	0-10	6.0-20	0.02-0.03	7.9-8.4	<2	Low-------	0.05			
38. Cryaquolls											
39. Cryoborolls											
40. Cryorthents											
41--------------- Earcree	0-16	10-18	2.0-6.0	0.10-0.13	5.6-7.3	<2	Low-------	0.20	5	3	2-4
	16-60	5-15	2.0-6.0	0.05-0.13	6.1-7.3	<2	Low-------	0.10			
42--------------- Earcree	0-16	10-18	2.0-6.0	0.10-0.13	5.6-7.3	<2	Low-------	0.10	5	3	2-4
	16-60	5-15	2.0-6.0	0.05-0.13	6.1-7.3	<2	Low-------	0.10			
43--------------- Earcree	0-28	10-18	2.0-6.0	0.10-0.13	5.6-7.3	<2	Low-------	0.10	5	3	2-4
	28-60	5-15	2.0-6.0	0.05-0.13	6.1-7.3	<2	Low-------	0.10			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
44*:											
Earcree----------	0-16	10-18	2.0-6.0	0.10-0.13	5.6-7.3	<2	Low--------	0.10	5	3	2-4
	16-60	5-15	2.0-6.0	0.05-0.13	6.1-7.3	<2	Low--------	0.10			
Branham----------	0-4	8-16	0.6-2.0	0.09-0.12	5.6-7.3	<2	Low--------	0.24	2	3	3-6
	4-22	10-18	0.6-2.0	0.06-0.07	6.6-7.8	<2	Low--------	0.15			
	22-30	4-10	2.0-6.0	0.02-0.03	6.6-7.8	<2	Low--------	0.10			
	30	---	---	---	---	---	-----------	----			
Rock outcrop.											
45. Fluvaquentic Haplaquolls											
46---------------- Garlet	0-15	10-18	0.6-2.0	0.07-0.08	5.6-6.5	<2	Low--------	0.10	3	3	1-4
	15-26	10-18	0.6-2.0	0.07-0.08	5.6-6.5	<2	Low--------	0.10			
	26-60	10-18	0.6-2.0	0.06-0.07	6.1-7.3	<2	Low--------	0.10			
47*:											
Garlet-----------	0-4	10-18	0.6-2.0	0.07-0.08	5.6-6.5	<2	Low--------	0.10	3	3	1-4
	4-15	10-18	0.6-2.0	0.08-0.09	5.6-6.5	<2	Low--------	0.10			
	15-26	10-18	0.6-2.0	0.07-0.08	5.6-6.5	<2	Low--------	0.10			
	26-60	10-18	0.6-2.0	0.06-0.07	6.1-7.3	<2	Low--------	0.10			
Rock outcrop.											
48*:											
Gaylord----------	0-9	15-27	0.6-2.0	0.16-0.20	6.1-7.3	<2	Low--------	0.43	5	6	3-6
	9-22	35-55	0.06-0.2	0.12-0.16	7.4-8.4	<2	High-------	0.32			
	22-60	35-50	0.06-0.2	0.12-0.16	7.9-9.0	<2	High-------	0.32			
Burnette---------	0-13	27-40	0.6-2.0	0.16-0.20	6.1-7.3	<2	Moderate	0.32	5	6	3-6
	13-26	35-50	0.06-0.2	0.14-0.18	6.6-7.8	<2	High-------	0.28			
	26-60	35-45	0.06-0.2	0.14-0.18	7.4-8.4	<2	High-------	0.28			
49, 50------------ Hanson	0-11	18-27	0.6-2.0	0.13-0.16	6.6-7.8	<2	Low--------	0.20	3	6	3-6
	11-60	15-32	0.6-2.0	0.06-0.07	7.4-8.4	<2	Low--------	0.05			
51*:											
Hanson-----------	0-7	15-27	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low--------	0.20	3	6	3-6
	7-14	15-32	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low--------	0.20			
	14-60	15-32	0.6-2.0	0.05-0.06	7.4-8.4	<2	Low--------	0.05			
Adel-------------	0-23	20-27	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low--------	0.28	5	6	4-8
	23-60	18-30	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low--------	0.28			
52*:											
Hanson-----------	0-11	15-27	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low--------	0.20	3	6	3-6
	11-60	15-32	0.6-2.0	0.05-0.06	7.4-8.4	<2	Low--------	0.05			
Raynesford-------	0-16	18-27	0.6-2.0	0.13-0.17	7.4-8.4	<2	Low--------	0.20	5	6	3-6
	16-20	18-35	0.2-0.6	0.13-0.17	7.9-8.4	<2	Low--------	0.20			
	20-60	18-35	0.2-0.6	0.11-0.14	7.9-8.4	<4	Low--------	0.15			
53*:											
Hanson-----------	0-11	18-27	0.6-2.0	0.13-0.16	6.6-7.8	<2	Low--------	0.20	3	6	3-6
	11-60	15-32	0.6-2.0	0.06-0.07	7.4-8.4	<2	Low--------	0.05			
Rock outcrop.											

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
54, 55----------- Hapgood	0-12	18-27	0.6-2.0	0.16-0.20	6.1-6.5	<2	Low-------	0.32	3	6	3-8
	12-60	18-32	0.6-2.0	0.08-0.09	6.6-7.3	<2	Low-------	0.15			
56--------------- Hapgood	0-18	18-27	0.6-2.0	0.08-0.12	6.1-6.5	<2	Low-------	0.15	3	8	3-8
	18-60	18-32	0.6-2.0	0.07-0.11	6.6-7.3	<2	Low-------	0.15			
57*:											
Hapgood---------	0-18	18-27	0.6-2.0	0.08-0.12	6.1-6.5	<2	Low-------	0.15	3	8	3-8
	18-60	18-32	0.6-2.0	0.07-0.11	6.6-7.3	<2	Low-------	0.15			
Sebud-----------	0-14	15-27	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low-------	0.15	3	8	3-6
	14-30	15-35	0.6-2.0	0.07-0.08	6.6-7.8	<2	Low-------	0.10			
	30-46	15-35	0.6-2.0	0.05-0.06	6.6-7.8	<2	Low-------	0.10			
	46-60	15-35	0.6-2.0	0.05-0.06	6.6-7.8	<2	Low-------	0.10			
58--------------- Havre	0-9	15-27	0.6-2.0	0.16-0.20	6.1-8.4	<2	Low-------	0.37	5	5	.5-2
	9-60	18-35	0.6-2.0	0.14-0.18	7.4-9.0	<4	Low-------	0.28			
59--------------- Havre	0-9	18-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37	5	6	1-3
	9-60	18-32	0.6-2.0	0.15-0.19	7.4-8.4	<4	Low-------	0.37			
60--------------- Kalsted	0-12	5-10	2.0-6.0	0.06-0.09	7.4-8.4	<2	Low-------	0.17	5	2	1-2
	12-30	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low-------	0.20			
	30-60	0-15	2.0-6.0	0.07-0.10	7.9-8.4	<2	Low-------	0.17			
61, 62----------- Kalsted	0-11	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low-------	0.20	5	3	1-2
	11-30	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low-------	0.20			
	30-60	0-15	2.0-6.0	0.07-0.10	7.9-8.4	<2	Low-------	0.17			
63--------------- Kalsted	0-7	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low-------	0.20	5	3	1-2
	7-30	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low-------	0.20			
	30-60	0-15	2.0-6.0	0.07-0.10	7.9-8.4	<2	Low-------	0.17			
64--------------- Kalsted	0-4	5-18	2.0-6.0	0.07-0.10	7.4-8.4	<2	Low-------	0.10	5	3	1-2
	4-60	5-15	2.0-6.0	0.07-0.10	7.9-8.4	<2	Low-------	0.17			
65--------------- Larry Variant	0-5	---	>20.0	0.25-0.30	6.1-7.3	<2	Low-------	0.00	3	8	50-70
	5-12	18-27	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low-------	0.37			
	12-29	20-35	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low-------	0.37			
	29-37	15-20	0.6-2.0	0.05-0.09	6.6-7.8	<2	Low-------	0.10			
	37-65	5-15	6.0-20	0.03-0.06	6.6-7.8	<2	Low-------	0.05			
66--------------- Leavitt	0-15	15-27	0.6-2.0	0.19-0.21	6.6-7.8	<2	Low-------	0.37	5	6	2-4
	15-40	20-35	0.6-2.0	0.16-0.18	6.6-7.8	<2	Moderate	0.20			
	40-60	20-70	0.6-2.0	0.09-0.13	7.9-8.4	<2	Low-------	0.10			
67--------------- Leavitt	0-7	15-27	0.6-2.0	0.13-0.16	6.6-7.3	<2	Low-------	0.20	5	6	2-5
	7-21	20-35	0.6-2.0	0.12-0.15	6.6-8.4	<2	Moderate	0.20			
	21-60	18-30	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low-------	0.24			
68--------------- Leavitt	0-4	15-27	0.6-2.0	0.14-0.17	6.6-7.3	<2	Low-------	0.24	5	6	2-5
	4-21	20-35	0.6-2.0	0.12-0.15	6.6-8.4	<2	Moderate	0.20			
	21-60	18-30	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low-------	0.24			
69*:											
Leavitt---------	0-10	15-27	0.6-2.0	0.13-0.16	6.6-7.3	<2	Low-------	0.20	5	6	2-5
	10-35	20-35	0.6-2.0	0.12-0.15	6.6-8.4	<2	Moderate	0.20			
	35-45	18-30	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low-------	0.24			
	45-60	10-25	0.6-2.0	0.07-0.09	7.4-8.4	<2	Low-------	0.15			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
69*:											
Adel------------	0-21	20-27	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low-------	0.28	5	6	4-8
	21-55	18-30	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.37			
	55-60	18-30	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low-------	0.28			
70*:											
Libeg-----------	0-7	15-27	0.6-2.0	0.10-0.12	6.1-7.3	<2	Low-------	0.15	3	8	2-4
	7-33	20-35	0.6-2.0	0.07-0.08	6.1-7.3	<2	Low-------	0.10			
	33-60	15-32	0.6-2.0	0.07-0.08	6.1-7.3	<2	Low-------	0.10			
Adel------------	0-21	15-27	0.6-2.0	0.14-0.16	6.6-7.3	<2	Low-------	0.20	5	5	4-8
	21-60	18-30	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low-------	0.28			
71*:											
Libeg-----------	0-13	15-27	0.6-2.0	0.10-0.12	6.1-7.3	<2	Low-------	0.15	3	8	2-4
	13-30	20-35	0.6-2.0	0.07-0.08	6.1-7.3	<2	Low-------	0.10			
	30-60	15-32	0.6-2.0	0.07-0.08	6.1-7.3	<2	Low-------	0.10			
Hapgood---------	0-18	18-27	0.6-2.0	0.11-0.15	6.1-6.5	<2	Low-------	0.20	3	6	3-8
	18-60	18-32	0.6-2.0	0.07-0.11	6.6-7.3	<2	Low-------	0.15			
72--------------- Loberg	0-11	18-27	0.06-0.2	0.09-0.11	5.1-6.5	<2	Low-------	0.15	3	8	1-3
	11-18	35-50	0.06-0.2	0.08-0.09	5.1-6.5	<2	Moderate	0.10			
	18-42	35-50	0.06-0.2	0.08-0.09	5.1-7.3	<2	Moderate	0.10			
	42-60	35-45	0.06-0.2	0.07-0.08	6.1-7.8	<2	Moderate	0.10			
73--------------- MacFarlane	0-14	0-10	2.0-6.0	0.07-0.09	5.6-6.5	<2	Low-------	0.10	3	3	1-3
	14-70	5-18	2.0-6.0	0.05-0.07	5.6-6.5	<2	Low-------	0.05			
	70-80	0-10	2.0-6.0	0.04-0.06	5.6-6.5	<2	Low-------	0.05			
74--------------- MacFarlane	0-14	0-10	2.0-6.0	0.07-0.09	5.6-6.5	<2	Low-------	0.10	3	8	1-3
	14-70	5-18	2.0-6.0	0.05-0.07	5.6-6.5	<2	Low-------	0.05			
	70-80	0-10	2.0-6.0	0.04-0.06	5.6-6.5	<2	Low-------	0.05			
75--------------- Marias	0-6	27-40	0.2-0.6	0.16-0.20	7.9-8.4	2-4	Moderate	0.43	5	4	.5-2
	6-60	35-60	<0.06	0.12-0.16	7.9-8.4	2-8	High------	0.37			
76--------------- Maxville	0-11	15-25	0.6-2.0	0.12-0.16	6.6-7.3	<2	Low-------	0.20	3	5	3-6
	11-19	18-30	0.6-2.0	0.12-0.16	6.6-7.3	<2	Low-------	0.28			
	19-34	18-30	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low-------	0.24			
	34-60	0-10	6.0-20	0.02-0.04	7.4-8.4	<2	Low-------	0.05			
77--------------- Maxville	0-8	15-25	0.6-2.0	0.12-0.16	6.6-7.3	<2	Low-------	0.20	3	5	3-6
	8-21	18-30	0.6-2.0	0.12-0.16	6.6-7.3	<2	Low-------	0.28			
	21-26	18-30	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low-------	0.24			
	26-60	0-10	6.0-20	0.02-0.04	7.4-8.4	<2	Low-------	0.05			
78*:											
Maxville--------	0-8	15-25	0.6-2.0	0.18-0.22	6.6-7.3	<2	Low-------	0.32	3	5	3-6
	8-21	18-30	0.6-2.0	0.12-0.16	6.6-7.3	<2	Low-------	0.28			
	21-26	18-30	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low-------	0.24			
	26-60	0-10	6.0-20	0.02-0.04	7.4-8.4	<2	Low-------	0.05			
Bearmouth-------	0-7	10-25	0.6-2.0	0.14-0.16	6.6-7.3	<2	Low-------	0.20	2	8	4-10
	7-16	10-25	0.6-2.0	0.08-0.09	6.6-7.8	<2	Low-------	0.15			
	16-60	0-10	6.0-20	0.02-0.03	6.6-7.8	<2	Low-------	0.02			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
79*:											
Maxville--------	0-9	15-25	0.6-2.0	0.18-0.22	6.6-7.3	<2	Low-------	0.32	3	5	3-6
	9-21	18-30	0.6-2.0	0.12-0.16	6.6-7.3	<2	Low-------	0.28			
	21-36	18-30	0.6-2.0	0.12-0.15	7.4-8.4	<2	Low-------	0.24			
	36-60	0-10	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
Bearmouth-------	0-6	10-25	0.6-2.0	0.14-0.16	6.6-7.3	<2	Low-------	0.20	2	8	4-10
	6-20	10-25	0.6-2.0	0.08-0.09	6.6-7.8	<2	Low-------	0.15			
	20-60	0-10	6.0-20	0.02-0.03	6.6-7.8	<2	Low-------	0.02			
80, 81----------- Mikesell	0-8	27-35	0.2-0.6	0.15-0.17	5.1-6.5	<2	Moderate	0.37	5	6	.5-1
	8-60	40-60	0.06-0.2	0.13-0.15	5.1-7.3	<2	High------	0.20			
82--------------- Musselshell	0-8	20-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37	3	4L	1-3
	8-25	10-27	0.6-2.0	0.14-0.18	7.9-9.0	<2	Low-------	0.20			
	25-41	10-18	0.6-2.0	0.06-0.10	7.9-9.0	<2	Low-------	0.20			
	41-60	10-18	2.0-6.0	0.06-0.10	7.9-9.0	<2	Low-------	0.05			
83--------------- Musselshell	0-8	20-27	0.6-2.0	0.14-0.18	7.4-8.4	<2	Low-------	0.20	3	4L	1-3
	8-25	10-27	0.6-2.0	0.14-0.18	7.9-9.0	<2	Low-------	0.20			
	25-50	10-18	0.6-2.0	0.06-0.10	7.9-9.0	<2	Low-------	0.20			
	50-60	10-18	2.0-6.0	0.06-0.10	7.9-9.0	<2	Low-------	0.05			
84*:											
Musselshell-----	0-8	20-27	0.6-2.0	0.14-0.18	7.4-8.4	<2	Low-------	0.20	3	4L	1-3
	8-25	10-18	0.6-2.0	0.14-0.18	7.9-9.0	<2	Low-------	0.20			
	25-60	10-18	2.0-6.0	0.06-0.10	7.9-9.0	<2	Low-------	0.05			
Amesha----------	0-8	15-25	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low-------	0.37	4	4L	1-3
	8-35	10-18	0.6-2.0	0.15-0.19	7.9-8.4	<2	Low-------	0.37			
	35-52	10-18	0.6-2.0	0.13-0.16	7.9-8.4	<2	Low-------	0.37			
	52	---	---	---	---	---	----------	----			
85*:											
Musselshell-----	0-8	20-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37	3	4L	1-3
	8-25	10-27	0.6-2.0	0.14-0.18	7.9-9.0	<2	Low-------	0.20			
	25-50	10-18	0.6-2.0	0.06-0.10	7.9-9.0	<2	Low-------	0.20			
	50-60	5-18	2.0-6.0	0.06-0.10	7.9-9.0	<2	Low-------	0.05			
Crago-----------	0-4	15-27	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low-------	0.20	3	4L	1-3
	4-14	20-35	0.6-2.0	0.07-0.08	7.4-8.4	<2	Low-------	0.15			
	14-32	18-30	0.6-2.0	0.03-0.04	7.4-8.4	<2	Low-------	0.10			
	32-60	0-20	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
86--------------- Neen	0-9	27-35	0.2-0.6	0.12-0.15	7.9-9.0	8-16	Moderate	0.37	5	4L	1-3
	9-32	20-35	0.2-0.6	0.11-0.14	7.9-9.0	8-16	Moderate	0.37			
	32-60	20-35	0.2-0.6	0.11-0.14	7.9-9.0	8-16	Moderate	0.37			
87--------------- Neen	0-7	27-35	0.2-0.6	0.15-0.19	7.4-8.4	2-4	Moderate	0.32	5	4L	1-3
	7-32	20-35	0.2-0.6	0.15-0.19	7.4-8.4	2-8	Moderate	0.32			
	32-60	20-35	0.2-0.6	0.14-0.17	7.4-9.0	2-8	Moderate	0.32			
88--------------- Neen	0-9	27-35	0.2-0.6	0.11-0.15	7.9-9.0	8-16	Moderate	0.37	5	8	1-3
	9-32	27-35	0.2-0.6	0.10-0.13	7.9-9.0	8-16	Moderate	0.37			
	32-60	27-35	0.2-0.6	0.09-0.12	7.9-9.0	8-16	Moderate	0.37			
89--------------- Nuley	0-7	15-20	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low-------	0.24	3	3	2-4
	7-11	20-35	0.6-2.0	0.12-0.15	6.6-8.4	<2	Moderate	0.32			
	11-24	5-15	0.6-2.0	0.10-0.13	7.4-8.4	<2	Low-------	0.24			
	24-42	0-5	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.10			
	42	---	---	---	---	---	----------	----			

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
90--------------- Nuley	0-7	27-30	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate	0.32	3	6	2-4
	7-15	20-35	0.6-2.0	0.12-0.15	6.6-8.4	<2	Moderate	0.32			
	15-24	5-15	0.6-2.0	0.10-0.13	7.4-8.4	<2	Low-------	0.24			
	24-50	0-5	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.10			
	50	---	---	---	---	---	----------	----			
91*:											
Nuley-----------	0-4	15-20	0.6-2.0	0.12-0.16	6.6-7.8	<2	Low-------	0.24	3	3	2-4
	4-11	20-35	0.6-2.0	0.12-0.15	6.6-8.4	<2	Moderate	0.32			
	11-24	5-15	0.6-2.0	0.10-0.13	7.4-8.4	<2	Low-------	0.24			
	24-42	0-5	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.10			
	42	---	---	---	---	---	----------	----			
Rock outcrop.											
92--------------- Oro Fino	0-10	15-25	0.6-2.0	0.15-0.19	6.6-7.3	<2	Low-------	0.28	5	5	3-6
	10-22	20-35	0.6-2.0	0.12-0.14	6.6-7.8	<2	Moderate	0.20			
	22-42	10-20	0.6-2.0	0.09-0.11	7.4-8.4	<2	Low-------	0.17			
	42-60	5-10	2.0-6.0	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
93*, 94*:											
Oro Fino--------	0-10	15-25	0.6-2.0	0.12-0.16	6.6-7.3	<2	Low-------	0.20	5	5	3-6
	10-22	20-35	0.6-2.0	0.12-0.14	6.6-7.8	<2	Moderate	0.20			
	22-42	10-20	0.6-2.0	0.09-0.11	7.4-8.4	<2	Low-------	0.17			
	42-60	5-10	2.0-6.0	0.02-0.03	7.4-8.4	<2	Low-------	0.05			
Poin------------	0-5	5-15	2.0-6.0	0.06-0.08	6.6-7.3	<2	Low-------	0.10	1	3	3-6
	5-12	5-15	2.0-6.0	0.06-0.08	6.6-7.8	<2	Low-------	0.10			
	12-19	5-15	2.0-6.0	0.03-0.05	6.6-7.8	<2	Low-------	0.05			
	19	---	---	---	---	---	----------	----			
95*:											
Pensore---------	0-4	10-25	0.6-2.0	0.08-0.09	7.9-8.4	<2	Low-------	0.10	1	4L	1-3
	4-16	10-25	0.6-2.0	0.07-0.08	7.9-8.4	<2	Low-------	0.10			
	16	---	---	---	---	---	----------	----			
Crago-----------	0-4	15-27	0.6-2.0	0.11-0.14	7.4-8.4	<2	Low-------	0.17	3	4L	1-3
	4-15	20-35	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low-------	0.15			
	15-60	15-30	6.0-20	0.04-0.06	7.4-8.4	<2	Low-------	0.10			
Rock outcrop.											
96*. Fits											
97*:											
Poin------------	0-7	5-15	2.0-6.0	0.06-0.08	6.6-7.3	<2	Low-------	0.10	1	3	3-6
	7-14	5-15	2.0-6.0	0.03-0.05	6.6-7.8	<2	Low-------	0.05			
	14	---	---	---	---	---	----------	----			
Earcree---------	0-28	10-18	2.0-6.0	0.10-0.13	5.6-7.3	<2	Low-------	0.10	5	3	2-4
	28-60	5-15	2.0-6.0	0.05-0.13	6.1-7.3	<2	Low-------	0.10			
98*:											
Poin------------	0-5	5-15	2.0-6.0	0.06-0.08	6.6-7.3	<2	Low-------	0.10	1	3	3-6
	5-12	5-15	2.0-6.0	0.06-0.08	6.6-7.8	<2	Low-------	0.10			
	12-19	5-15	2.0-6.0	0.03-0.05	6.6-7.8	<2	Low-------	0.05			
	19	---	---	---	---	---	----------	----			
Rock outcrop.											

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
99*:											
Poin-------------	0-7	5-15	2.0-6.0	0.06-0.08	6.6-7.3	<2	Low--------	0.10	1	3	3-6
	7-14	5-15	2.0-6.0	0.03-0.05	6.6-7.8	<2	Low--------	0.05			
	14	---	---	---	---	---	----------	----			
Sebud------------	0-14	15-20	0.6-2.0	0.07-0.09	6.6-7.8	<2	Low--------	0.10	3	6	3-6
	14-46	15-35	0.6-2.0	0.05-0.07	6.6-7.8	<2	Low--------	0.10			
	46-60	15-35	0.6-2.0	0.05-0.07	6.6-7.8	<2	Low--------	0.10			
100--------------- Raynesford	0-16	18-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.32	5	6	3-6
	16-20	18-35	0.2-0.6	0.13-0.16	7.9-8.4	<4	Low--------	0.28			
	20-60	18-35	0.2-0.6	0.08-0.10	7.9-8.4	<4	Low--------	0.10			
101*:											
Redchief Variant	0-6	20-27	0.6-2.0	0.16-0.20	6.1-7.3	<2	Low--------	0.37	5	6	3-6
	6-12	20-27	0.6-2.0	0.13-0.17	6.1-7.3	<2	Low--------	0.20			
	12-20	27-35	0.2-0.6	0.10-0.13	6.1-7.3	<2	Moderate	0.20			
	20-45	35-50	0.06-0.2	0.07-0.08	6.1-7.3	<2	Moderate	0.15			
	45-60	27-40	0.2-0.6	0.07-0.08	6.1-7.3	<2	Moderate	0.15			
Hapgood----------	0-22	18-27	0.6-2.0	0.14-0.18	6.1-6.5	<2	Low--------	0.20	3	6	3-8
	22-60	18-32	0.6-2.0	0.08-0.09	6.6-7.3	<2	Low--------	0.15			
102--------------- Rentsac	0-4	7-18	2.0-6.0	0.08-0.12	6.6-8.4	<2	Low--------	0.10	1	5	.5-2
	4-16	7-18	2.0-6.0	0.07-0.09	7.4-8.4	<4	Low--------	0.10			
	16	---	---	---	---	---	----------	----			
103*:											
Rentsac----------	0-4	7-18	2.0-6.0	0.12-0.16	6.6-8.4	<2	Low--------	0.20	1	3	.5-2
	4-16	7-18	2.0-6.0	0.07-0.09	7.4-8.4	<4	Low--------	0.10			
	16	---	---	---	---	---	----------	----			
Kalsted----------	0-4	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low--------	0.20	5	3	1-2
	4-60	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low--------	0.20			
104*:											
Rentsac----------	0-4	7-18	2.0-6.0	0.12-0.16	6.6-8.4	<2	Low--------	0.20	1	5	.5-2
	4-16	7-18	2.0-6.0	0.07-0.09	7.4-8.4	<4	Low--------	0.10			
	16	---	---	---	---	---	----------	----			
Varney-----------	0-3	27-30	0.6-2.0	0.12-0.15	6.6-7.3	<2	Moderate	0.17	5	6	2-4
	3-11	30-35	0.6-2.0	0.12-0.15	6.6-7.8	<2	Moderate	0.20			
	11-60	10-30	0.6-2.0	0.11-0.13	7.4-8.4	<2	Low--------	0.20			
105--------------- Rivra	0-12	7-15	2.0-6.0	0.07-0.08	6.6-8.4	<2	Low--------	0.05	1	3	.5-2
	12-60	0-5	>20	0.02-0.03	7.4-8.4	<2	Low--------	0.02			
106*:											
Rivra------------	0-12	5-15	2.0-6.0	0.10-0.11	6.6-8.4	<2	Low--------	0.10	1	3	.5-2
	12-60	0-5	>20	0.02-0.03	7.4-8.4	<2	Low--------	0.02			
Fluvaquents.											
107*:											
Rivra------------	0-4	5-15	2.0-6.0	0.10-0.11	6.6-8.4	<2	Low--------	0.10	1	3	.5-2
	4-60	0-5	>20	0.02-0.03	7.4-8.4	<2	Low--------	0.02			
Ryell------------	0-7	10-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.37	3	4L	.5-1
	7-23	10-18	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low--------	0.37			
	23-60	0-10	6.0-20	0.02-0.03	7.4-8.4	<4	Low--------	0.05			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
107*:											
Havre-----------	0-9	15-27	0.6-2.0	0.16-0.20	6.1-8.4	<2	Low-------	0.37	5	5	.5-2
	9-60	18-35	0.6-2.0	0.14-0.18	7.4-9.0	<4	Low-------	0.28			
108*:											
Rochester-------	0-3	0-10	6.0-20	0.04-0.05	6.6-7.3	<2	Low-------	0.05	2	8	2-4
	3-14	0-10	6.0-20	0.04-0.05	6.6-7.3	<2	Low-------	0.05			
	14-60	0-10	6.0-20	0.03-0.04	6.6-7.8	<2	Low-------	0.05			
Rock outcrop.											
109*:											
Rock outcrop.											
Cryoborolls.											
Cryochrepts.											
110*:											
Ryell-----------	0-7	10-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37	3	4L	.5-1
	7-23	10-18	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low-------	0.37			
	23-60	0-10	6.0-20	0.02-0.03	7.4-8.4	<4	Low-------	0.05			
Rivra-----------	0-5	5-15	2.0-6.0	0.10-0.11	6.6-8.4	<2	Low-------	0.10	1	3	.5-2
	5-60	0-5	>20	0.02-0.03	7.4-8.4	<2	Low-------	0.02			
111*:											
Ryell-----------	0-6	5-12	0.6-2.0	0.11-0.13	7.9-9.0	4-8	Low-------	0.24	2	3	1-3
	6-28	5-20	0.6-2.0	0.11-0.13	>8.4	8-16	Low-------	0.37			
	28-60	2-7	6.0-20	0.02-0.03	>8.4	8-16	Low-------	0.05			
Rivra-----------	0-6	5-15	2.0-6.0	0.12-0.15	7.9-9.0	8-16	Low-------	0.24	1	3	.5-2
	6-13	5-15	2.0-6.0	0.09-0.11	7.9-9.0	8-16	Low-------	0.10			
	13-60	0-5	>20	0.02-0.03	>8.4	8-16	Low-------	0.02			
112-------------- Saunders	0-5	27-35	0.2-0.6	0.12-0.14	7.4-8.4	8-16	Moderate	0.32	5	4L	3-5
	5-32	27-35	0.06-0.2	0.14-0.17	7.9-8.4	4-8	Moderate	0.37			
	32-60	30-50	0.06-0.2	0.13-0.16	7.9-9.0	4-8	Moderate	0.32			
113-------------- Saunders	0-5	27-35	0.2-0.6	0.16-0.20	7.4-8.4	<4	Moderate	0.32	5	4L	3-5
	5-32	27-35	0.06-0.2	0.15-0.19	7.9-8.4	<4	Moderate	0.37			
	32-60	30-50	0.06-0.2	0.13-0.17	7.4-8.4	<4	Moderate	0.32			
114-------------- Scravo	0-7	10-20	2.0-6.0	0.12-0.15	7.4-7.8	<2	Low-------	0.20	2	3	2-5
	7-16	5-15	2.0-6.0	0.06-0.08	7.9-8.4	<2	Low-------	0.10			
	16-60	0-10	6.0-20.0	0.02-0.03	7.9-8.4	<2	Low-------	0.05			
115-------------- Scravo	0-5	15-25	0.6-2.0	0.08-0.10	7.4-7.8	<2	Low-------	0.10	2	4L	2-5
	5-9	5-15	2.0-6.0	0.05-0.06	7.9-8.4	<2	Low-------	0.10			
	9-60	0-10	6.0-20	0.02-0.03	7.9-8.4	<2	Low-------	0.05			
116*:											
Scravo----------	0-5	15-25	0.6-2.0	0.08-0.10	7.4-7.8	<2	Low-------	0.10	2	4L	2-5
	5-17	5-15	2.0-6.0	0.05-0.06	7.9-8.4	<2	Low-------	0.10			
	17-60	0-10	6.0-20	0.02-0.03	7.9-8.4	<2	Low-------	0.05			
Crago-----------	0-7	15-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low-------	0.37	3	4L	1-3
	7-14	20-35	0.6-2.0	0.07-0.08	7.4-8.4	<2	Low-------	0.15			
	14-32	18-30	0.6-2.0	0.03-0.04	7.4-8.4	<2	Low-------	0.10			
	32-60	0-20	6.0-20	0.02-0.03	7.4-8.4	<2	Low-------	0.05			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
117*:											
Scravo----------	0-5	10-20	2.0-6.0	0.09-0.11	7.4-7.8	<2	Low--------	0.15	2	3	2-5
	5-17	5-15	2.0-6.0	0.05-0.06	7.9-8.4	<2	Low--------	0.10			
	17-60	0-10	6.0-20.0	0.02-0.03	7.9-8.4	<2	Low--------	0.05			
Thess-----------	0-7	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.37	3	4L	1-3
	7-30	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.02			
	30-60	0-5	>20.0	0.01-0.02	7.4-8.4	<2	Low--------	0.02			
118*:											
Sebud-----------	0-14	15-27	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low--------	0.15	3	8	3-6
	14-30	15-35	0.6-2.0	0.07-0.08	6.6-7.8	<2	Low--------	0.10			
	30-46	15-35	0.6-2.0	0.05-0.06	6.6-7.8	<2	Low--------	0.10			
	46-60	15-35	0.6-2.0	0.05-0.06	6.6-7.8	<2	Low--------	0.10			
Hapgood---------	0-18	18-27	0.6-2.0	0.14-0.18	6.1-6.5	<2	Low--------	0.20	3	6	3-8
	18-60	18-32	0.6-2.0	0.08-0.09	6.6-7.3	<2	Low--------	0.15			
119*:											
Sebud-----------	0-14	15-27	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low--------	0.15	3	6	3-6
	14-30	15-35	0.6-2.0	0.07-0.08	6.6-7.8	<2	Low--------	0.10			
	30-46	15-35	0.6-2.0	0.05-0.06	6.6-7.8	<2	Low--------	0.10			
	46-60	15-35	0.6-2.0	0.05-0.06	6.6-7.8	<2	Low--------	0.10			
Hapgood---------	0-18	18-27	0.6-2.0	0.14-0.18	6.1-6.5	<2	Low--------	0.20	3	6	3-8
	18-60	18-32	0.6-2.0	0.08-0.09	6.6-7.3	<2	Low--------	0.15			
Rock outcrop.											
120*:											
Sebud-----------	0-8	15-20	0.6-2.0	0.07-0.09	6.6-7.8	<2	Low--------	0.10	3	3	3-6
	8-23	15-35	0.6-2.0	0.05-0.07	6.6-7.8	<2	Low--------	0.10			
	23-60	15-35	0.6-2.0	0.05-0.07	6.6-7.8	<2	Low--------	0.10			
Rochester-------	0-17	0-10	6.0-20	0.04-0.05	6.6-7.3	<2	Low--------	0.05	2	8	2-4
	17-60	0-10	6.0-20	0.04-0.05	6.6-7.3	<2	Low--------	0.05			
Rock outcrop.											
121-------------- Shadow	0-10	7-15	2.0-6.0	0.07-0.09	5.6-7.3	<2	Low--------	0.10	3	5	3-5
	10-30	5-15	2.0-6.0	0.07-0.08	5.6-7.3	<2	Low--------	0.05			
	30-60	5-15	2.0-6.0	0.02-0.03	5.6-7.8	<2	Low--------	0.05			
122-------------- Shadow	0-6	7-15	2.0-6.0	0.08-0.11	5.6-7.3	<2	Low--------	0.10	3	5	3-5
	6-17	5-15	2.0-6.0	0.07-0.08	5.6-7.3	<2	Low--------	0.05			
	17-60	5-15	2.0-6.0	0.03-0.04	5.6-7.8	<2	Low--------	0.05			
123*:											
Shadow very channery sandy loam-----------	0-17	7-15	2.0-6.0	0.07-0.09	5.6-7.3	<2	Low--------	0.10	3	3	3-5
	17-30	5-15	2.0-6.0	0.07-0.08	5.6-7.3	<2	Low--------	0.05			
	30-60	5-15	2.0-6.0	0.03-0.04	5.6-7.8	<2	Low--------	0.05			
Shadow stony loam-----------	0-10	7-15	2.0-6.0	0.09-0.12	5.6-7.3	<2	Low--------	0.10	3	5	3-5
	10-30	5-15	2.0-6.0	0.07-0.08	5.6-7.3	<2	Low--------	0.05			
	30-60	5-15	2.0-6.0	0.03-0.04	5.6-7.8	<2	Low--------	0.05			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
124*:											
Shadow very channery sandy loam-----------	0-9	7-15	2.0-6.0	0.07-0.09	5.6-7.3	<2	Low-------	0.10	3	3	3-5
	9-30	5-15	2.0-6.0	0.07-0.08	5.6-7.3	<2	Low-------	0.05			
	30-60	5-15	2.0-6.0	0.03-0.04	5.6-7.8	<2	Low-------	0.05			
Shadow stony loam-----------	0-10	7-15	2.0-6.0	0.09-0.12	5.6-7.3	<2	Low-------	0.10	3	5	3-5
	10-30	5-15	2.0-6.0	0.07-0.08	5.6-7.3	<2	Low-------	0.05			
	30-60	5-15	2.0-6.0	0.03-0.04	5.6-7.8	<2	Low-------	0.05			
125*:											
Shadow----------	0-17	7-15	2.0-6.0	0.12-0.15	5.6-7.3	<2	Low-------	0.17	3	5	3-5
	17-30	5-15	2.0-6.0	0.07-0.08	5.6-7.3	<2	Low-------	0.05			
	30-60	5-15	2.0-6.0	0.03-0.04	5.6-7.8	<2	Low-------	0.05			
Mikesell--------	0-8	27-35	0.2-0.6	0.15-0.17	5.1-6.5	<2	Moderate	0.37	5	6	.5-1
	8-60	40-60	0.06-0.2	0.13-0.15	5.1-7.3	<2	High------	0.20			
Worock----------	0-12	15-25	0.6-2.0	0.12-0.15	5.1-6.5	<2	Low-------	0.24	3	5	2-4
	12-24	18-30	0.6-2.0	0.10-0.13	5.1-6.5	<2	Low-------	0.24			
	24-60	25-35	0.2-0.6	0.07-0.08	5.1-7.8	<2	Moderate	0.15			
126-------------- Shedhorn	0-12	27-35	0.2-0.6	0.14-0.18	6.1-6.5	<2	Low-------	0.32	5	6	3-6
	12-40	35-45	0.06-0.2	0.10-0.14	6.1-7.3	<2	Moderate	0.28			
	40-60	35-45	0.06-0.2	0.09-0.13	6.6-7.8	<2	Moderate	0.28			
127*:											
Shedhorn--------	0-12	27-35	0.2-0.6	0.14-0.18	6.1-6.5	<2	Low-------	0.32	5	6	3-6
	12-40	35-45	0.06-0.2	0.10-0.14	6.1-7.3	<2	Moderate	0.28			
	40-60	35-45	0.06-0.2	0.09-0.13	6.6-7.8	<2	Moderate	0.28			
Garlet----------	0-15	10-25	0.6-2.0	0.09-0.11	5.6-6.5	<2	Low-------	0.15	3	5	1-4
	15-26	10-25	0.6-2.0	0.08-0.09	5.6-6.5	<2	Low-------	0.10			
	26-60	10-25	0.6-2.0	0.07-0.08	6.1-7.3	<2	Low-------	0.10			
Rock outcrop.											
128*:											
Shedhorn--------	0-12	27-35	0.2-0.6	0.14-0.18	6.1-6.5	<2	Low-------	0.32	5	6	3-6
	12-40	35-45	0.06-0.2	0.10-0.14	6.1-7.3	<2	Moderate	0.28			
	40-60	35-45	0.06-0.2	0.09-0.13	6.6-7.8	<2	Moderate	0.28			
Rock outcrop.											
129*:											
Shurley---------	0-4	5-15	2.0-6.0	0.04-0.06	6.6-8.4	<2	Low-------	0.10	2	3	.8-2
	4-10	5-15	2.0-6.0	0.04-0.06	6.6-8.4	<2	Low-------	0.10			
	10-60	0-10	6.0-20.0	0.01-0.03	7.4-8.4	<2	Low-------	0.05			
Rentsac---------	0-4	7-18	2.0-6.0	0.12-0.16	6.6-8.4	<2	Low-------	0.20	1	3	.5-2
	4-12	7-18	2.0-6.0	0.07-0.09	7.4-8.4	<4	Low-------	0.10			
	12	---	---	---	---	---	----------	----			
Rock outcrop.											
130*:											
Shurley---------	0-4	5-15	2.0-6.0	0.04-0.06	6.6-8.4	<2	Low-------	0.10	2	3	.8-2
	4-10	5-15	2.0-6.0	0.04-0.06	6.6-8.4	<2	Low-------	0.10			
	10-60	0-10	6.0-20	0.01-0.03	7.4-8.4	<2	Low-------	0.05			

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
130*: Rock outcrop.											
131----------------- Thess	0-7	15-20	0.6-2.0	0.12-0.16	7.4-8.4	<2	Low--------	0.24	3	3	1-3
	7-30	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.02			
	30-60	0-5	>20.0	0.01-0.02	7.4-8.4	<2	Low--------	0.02			
132----------------- Thess	0-7	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.37	3	4L	1-3
	7-30	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.02			
	30-60	0-5	>20.0	0.01-0.02	7.4-8.4	<2	Low--------	0.02			
133*:											
Thess--------------	0-7	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.37	3	4L	1-3
	7-30	18-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.02			
	30-60	0-5	>20.0	0.01-0.02	7.4-8.4	<2	Low--------	0.02			
Amesha-------------	0-7	15-25	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.37	5	4L	1-3
	7-50	10-18	0.6-2.0	0.14-0.17	7.9-8.4	<2	Low--------	0.37			
	50-60	10-18	0.6-2.0	0.12-0.15	7.9-8.4	<2	Low--------	0.28			
134----------------- Tiban	0-8	18-27	0.6-2.0	0.11-0.14	6.6-7.3	<2	Low--------	0.20	3	6	3-5
	8-14	18-35	0.6-2.0	0.10-0.13	7.4-8.4	<2	Low--------	0.20			
	14-60	18-35	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low--------	0.15			
135----------------- Tiban	0-4	18-27	0.6-2.0	0.10-0.13	6.6-7.3	<2	Low--------	0.15	3	8	3-5
	4-14	18-35	0.6-2.0	0.10-0.13	7.4-8.4	<2	Low--------	0.20			
	14-60	18-35	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low--------	0.15			
136*:											
Tiban--------------	0-7	18-27	0.6-2.0	0.10-0.13	6.6-7.3	<2	Low--------	0.15	3	8	3-5
	7-22	18-35	0.6-2.0	0.10-0.13	7.4-8.4	<2	Low--------	0.20			
	22-60	18-35	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low--------	0.15			
Rock outcrop.											
137----------------- Tineman	0-7	10-20	0.6-2.0	0.12-0.15	6.1-7.3	<2	Low--------	0.20	3	5	3-6
	7-28	10-25	0.6-2.0	0.08-0.10	6.1-7.3	<2	Low--------	0.15			
	28-60	0-5	6.0-20	0.03-0.04	6.6-7.8	<2	Low--------	0.05			
138*:											
Tineman------------	0-7	10-20	0.6-2.0	0.12-0.15	6.1-7.3	<2	Low--------	0.20	3	5	3-6
	7-21	10-25	0.6-2.0	0.08-0.10	6.1-7.3	<2	Low--------	0.15			
	21-38	7-20	0.6-2.0	0.07-0.08	6.1-7.3	<2	Low--------	0.10			
	38-60	0-5	6.0-20	0.03-0.04	6.6-7.8	<2	Low--------	0.05			
Earcree------------	0-18	10-18	2.0-6.0	0.10-0.13	5.6-6.5	<2	Low--------	0.20	5	3	2-4
	18-60	5-15	2.0-6.0	0.05-0.13	6.1-7.3	<2	Low--------	0.10			
139, 140------------ Trimad	0-6	20-27	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low--------	0.20	3	5	2-4
	6-9	10-15	0.6-2.0	0.11-0.14	7.4-8.4	<2	Low--------	0.20			
	9-18	10-15	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low--------	0.10			
	18-60	5-10	2.0-6.0	0.06-0.07	7.4-8.4	<2	Low--------	0.05			
141----------------- Trimad	0-2	20-27	0.6-2.0	0.10-0.12	6.6-7.8	<2	Low--------	0.17	3	8	2-4
	2-9	10-15	0.6-2.0	0.11-0.14	7.4-8.4	<2	Low--------	0.20			
	9-18	10-15	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low--------	0.10			
	18-60	5-10	2.0-6.0	0.06-0.07	7.4-8.4	<2	Low--------	0.05			

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
142*:											
Trimad----------	0-2	20-27	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low-------	0.20	3	5	2-4
	2-9	10-15	0.6-2.0	0.11-0.14	7.4-8.4	<2	Low-------	0.20			
	9-18	10-15	0.6-2.0	0.08-0.10	7.4-8.4	<2	Low-------	0.10			
	18-60	5-10	2.0-6.0	0.06-0.07	7.4-8.4	<2	Low-------	0.05			
Kalsted---------	0-4	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low-------	0.20	5	3	1-2
	4-60	5-18	2.0-6.0	0.10-0.13	7.4-8.4	<2	Low-------	0.20			
143-------------- Trudau	0-7	20-27	0.6-2.0	0.16-0.20	8.5-9.0	<2	Low-------	0.37	5	4L	1-3
	7-30	20-35	0.2-0.6	0.09-0.11	8.5-9.0	8-16	Moderate	0.37			
	30-60	18-27	0.2-0.6	0.08-0.10	8.5-9.0	8-16	Low-------	0.32			
144-------------- Trudau	0-7	20-27	0.6-2.0	0.18-0.20	7.4-7.8	<2	Low-------	0.37	5	4L	1-3
	7-27	20-35	0.2-0.6	0.17-0.19	7.4-8.4	<4	Moderate	0.37			
	27-60	18-27	0.2-0.6	0.12-0.14	7.4-8.4	<8	Low-------	0.32			
145, 146. Ustic Torriorthents											
147, 148--------- Varney	0-5	27-30	0.6-2.0	0.14-0.18	6.6-7.3	<2	Moderate	0.32	5	6	2-4
	5-16	30-35	0.6-2.0	0.12-0.15	6.6-7.8	<2	Moderate	0.20			
	16-48	10-30	0.6-2.0	0.11-0.13	7.4-8.4	<2	Low-------	0.20			
	48-60	5-15	0.6-2.0	0.09-0.10	7.9-8.4	<2	Low-------	0.20			
149-------------- Varney	0-5	27-30	0.6-2.0	0.12-0.14	6.6-7.3	<2	Moderate	0.17	5	6	2-4
	5-16	30-35	0.6-2.0	0.12-0.15	6.6-7.8	<2	Moderate	0.20			
	16-48	10-30	0.6-2.0	0.11-0.13	7.4-8.4	<2	Moderate	0.20			
	48-60	5-15	0.6-2.0	0.09-0.10	7.9-8.4	<2	Low-------	0.20			
150, 151--------- Villy	0-10	27-35	0.2-0.6	0.16-0.20	7.9-8.4	<2	Moderate	0.32	5	4L	2-5
	10-42	18-35	0.2-0.6	0.16-0.22	7.9-8.4	<2	Moderate	0.37			
	42-60	15-35	0.2-2.0	0.15-0.19	7.9-8.4	<2	Moderate	0.37			
152*:											
Whitecow--------	0-9	18-27	0.6-2.0	0.07-0.08	7.4-8.4	<2	Low-------	0.10	3	4L	.5-2
	9-20	18-35	0.6-2.0	0.07-0.08	7.4-9.0	<2	Low-------	0.10			
	20-60	18-35	0.6-2.0	0.05-0.06	7.4-9.0	<2	Low-------	0.05			
Rock outcrop.											
153*:											
Whitore channery loam-----------	0-12	20-27	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low-------	0.20	3	6	.5-2
	12-60	20-35	0.6-2.0	0.06-0.07	7.4-9.0	<2	Moderate	0.10			
Whitore stony loam-----------	0-12	20-27	0.6-2.0	0.13-0.16	6.6-7.8	<2	Low-------	0.20	3	6	.5-2
	12-60	20-35	0.6-2.0	0.06-0.07	7.4-9.0	<2	Moderate	0.10			
154*:											
Whitore---------	0-6	27-35	0.6-2.0	0.07-0.08	6.6-7.8	<2	Moderate	0.10	3	6	.5-2
	6-60	20-35	0.6-2.0	0.06-0.07	7.4-9.0	<2	Moderate	0.10			
Mikesell--------	0-8	27-35	0.2-0.6	0.15-0.17	5.1-6.5	<2	Moderate	0.37	5	6	.5-1
	8-60	40-60	0.06-0.2	0.13-0.15	5.1-7.3	<2	High------	0.20			
Rock outcrop.											

See footnote at end of table.

TABLE 13.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	In/hr	In/in	pH	mmhos/cm					Pct
155*:											
Whitore channery loam-----------	0-12	20-27	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low-------	0.20	3	6	.5-2
	12-60	20-35	0.6-2.0	0.06-0.07	7.4-9.0	<2	Moderate	0.10			
Whitore stony loam-----------	0-12	20-27	0.6-2.0	0.13-0.16	6.6-7.8	<2	Low-------	0.20	3	6	.5-2
	12-60	20-35	0.6-2.0	0.06-0.07	7.4-9.0	<2	Moderate	0.10			
Rock outcrop.											
156-------------- Woodhall	0-10	10-20	0.6-2.0	0.12-0.15	6.1-7.8	<2	Low-------	0.20	2	5	4-10
	10-30	20-35	0.6-2.0	0.08-0.09	6.1-7.8	<2	Low-------	0.15			
	30	---	---	---	---	---	----------	----			
157*:											
Woodhall--------	0-10	10-20	0.6-2.0	0.12-0.15	6.1-7.8	<2	Low-------	0.20	2	5	4-10
	10-30	20-35	0.6-2.0	0.08-0.09	6.1-7.8	<2	Low-------	0.15			
	30	---	---	---	---	---	----------	----			
Blaine----------	0-6	15-25	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low-------	0.24	2	6	2-5
	6-10	27-35	0.6-2.0	0.08-0.09	7.4-7.8	<2	Moderate	0.10			
	10-25	15-25	0.6-2.0	0.06-0.07	7.4-8.4	<2	Low-------	0.05			
	25	---	---	---	---	---	----------	----			
Hapgood---------	0-18	18-27	0.6-2.0	0.14-0.18	6.1-6.5	<2	Low-------	0.20	3	6	3-8
	18-60	18-32	0.6-2.0	0.08-0.09	6.6-7.3	<2	Low-------	0.15			
158-------------- Worock	0-14	15-25	0.6-2.0	0.12-0.15	5.1-6.5	<2	Low-------	0.24	3	5	2-4
	14-60	25-35	0.2-0.6	0.07-0.08	5.1-7.8	<2	Moderate	0.15			
159*:											
Worock----------	0-18	18-27	0.6-2.0	0.10-0.12	5.1-6.5	<2	Low-------	0.15	3	8	1-3
	18-52	25-35	0.2-0.6	0.07-0.08	5.1-6.5	<2	Moderate	0.15			
	52-60	25-35	0.2-0.6	0.07-0.08	5.1-7.8	<2	Moderate	0.15			
Mikesell--------	0-8	27-35	0.2-0.6	0.15-0.17	5.1-6.5	<2	Moderate	0.37	5	6	.5-1
	8-60	40-60	0.06-0.2	0.13-0.15	5.1-7.3	<2	High------	0.20			
160-------------- Yetull	0-8	0-10	6.0-20	0.07-0.10	6.6-7.8	<2	Low-------	0.17	5	2	1-2
	8-60	0-10	6.0-20	0.05-0.07	7.4-8.4	<4	Low-------	0.17			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1, 2-------------- Adel	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
3----------------- Amesha	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
4----------------- Amesha	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
5*:												
Amesha-----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
Musselshell------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
6----------------- Amsterdam	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
7*:												
Amsterdam--------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Brocko Variant---	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
8*:												
Aquic Cryoboralfs.												
Typic Cryochrepts.												
9*:												
Armitage---------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Thess------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
10, 11, 12, 13---- Attewan	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
14*. Badland												
15, 16------------ Bearmouth	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
17----------------- Beaverell	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
18*:												
Blackhall---------	D	None---------	---	---	>6.0	---	---	10-20	Soft	Moderate	High-----	Low.
Rock outcrop.												
19----------------- Blaine	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Low.
20. Borohemists												
21----------------- Branham	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
22*:												
Branham----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
Rock outcrop.												
23, 24------------ Bridger	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
25*:												
Bridger----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Cryaquolls.												
26*:												
Bridger----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Tiban------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Adel-------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
27, 28------------ Brocko	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
29*:												
Brocko-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Crago------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
30----------------- Brocko Variant	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
31----------------- Bullrey	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Moderate.
32*:												
Comad------------	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
Earcree----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
33, 34, 35-------- Crago	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
36*:												
Crago------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Kalsted----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Pensore----------	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.
37*:												
Crago------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Scravo-----------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High-----	Low.
38. Cryaquolls												
39. Cryoborolls												
40. Cryorthents												
41, 42, 43-------- Earcree	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
44*:												
Earcree----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Branham----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
Rock outcrop.												
45. Fluvaquentic Haplaquolls												
46----------------- Garlet	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
47*:												
Garlet----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Rock outcrop.												
48*:												
Gaylord----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Burnette---------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
49, 50------------ Hanson	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
51*:												
Hanson-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Adel-------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
52*:												
Hanson-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Raynesford-------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
53*:												
Hanson-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Rock outcrop.												
54, 55, 56-------- Hapgood	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
57*:												
Hapgood----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Sebud------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
58---------------- Havre	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
59---------------- Havre	C	Occasional	Brief-----	Apr-Jun	3.5-5.0	Apparent	Mar-Sep	>60	---	Moderate	High-----	Low.
60, 61, 62, 63, 64---------------- Kalsted	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
65---------------- Larry Variant	D	Rare--------	Brief-----	Jan-Apr	0-1.5	Apparent	Mar-Jul	>60	---	High-----	High-----	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
66, 67, 68-------- Leavitt	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
69*:												
Leavitt----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Adel-------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
70*:												
Libeg------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Adel-------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
71*:												
Libeg------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Hapgood----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
72---------------- Loberg	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
73, 74------------ MacFarlane	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
75---------------- Marias	D	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
76, 77------------ Maxville	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
78*:												
Maxville---------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Bearmouth--------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
79*:												
Maxville---------	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Bearmouth--------	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
80, 81------------ Mikesell	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
82, 83------------ Musselshell	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
84*:												
Musselshell------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
84*:												
Amesha-----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
85*:												
Musselshell------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Crago------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
86---------------- Neen	C	Rare--------	---	---	2.0-3.5	Apparent	Apr-Aug	>60	---	High-----	High-----	Moderate.
87---------------- Neen	B	Rare--------	---	---	4.0-6.0	Apparent	Apr-Aug	>60	---	High-----	High-----	Low.
88---------------- Neen	D	Occasional	Brief-----	Jan-Jun	0.5-1.0	Apparent	Apr-Aug	>60	---	High-----	High-----	Moderate.
89, 90------------ Nuley	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
91*:												
Nuley------------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
Rock outcrop.												
92---------------- Oro Fino	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
93*, 94*:												
Oro Fino---------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Poin-------------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate	Low.
95*:												
Pensore----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.
Crago------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Rock outcrop.												
96*. Pits												
97*:												
Poin-------------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate	Low.
Earcree----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
98*:												
Poin	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate	Low.
Rock outcrop.												
99*:												
Poin	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate	Low.
Sebud	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
100 Raynesford	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
101*:												
Redchief Variant	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Hapgood	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
102 Rentsac	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
103*:												
Rentsac	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
Kalsted	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
104*:												
Rentsac	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
Varney	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
105 Rivra	D	Rare	Brief	---	>6.0	---	---	>60	---	Low	High	Low.
106*:												
Rivra	D	Frequent	Brief to long.	Jan-Jun	0-3.5	Apparent	Apr-Jul	>60	---	Low	High	Low.
Fluvaquents.												
107*:												
Rivra	A	Rare	Brief	---	0-3.5	---	---	>60	---	Low	High	Low.
Ryell	B	Rare	Brief	---	>6.0	---	---	>60	---	Moderate	High	Low.
Havre	B	Rare	Brief	---	>6.0	---	---	>60	---	Moderate	High	Low.
108*:												
Rochester	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
108*:												
Rock outcrop.												
109*:												
Rock outcrop.												
Cryoborolls.												
Cryochrepts.												
110*:												
Ryell------------	B	Rare--------	Brief-----	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Rivra------------	D	Rare--------	Brief-----	---	>6.0	---	---	>60	---	Low------	High-----	Low.
111*:												
Ryell------------	D	Rare--------	Brief-----	---	1.0-3.0	Apparent	Jun-Sep	>60	---	High-----	High-----	High.
Rivra------------	D	Rare--------	Brief-----	---	0.5-1.5	Apparent	Jun-Sep	>60	---	High-----	High-----	High.
112--------------- Saunders	D	Rare--------	Brief-----	Jan-Jun	1.0-2.0	Apparent	Apr-Sep	>60	---	High-----	High-----	Moderate.
113--------------- Saunders	D	Rare--------	Brief-----	Jan-Jun	3.0-5.0	Apparent	Apr-Sep	>60	---	High-----	High-----	Low.
114, 115---------- Scravo	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
116*:												
Scravo-----------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Crago------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
117*:												
Scravo-----------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Thess------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
118*:												
Sebud------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Hapgood----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
119*:												
Sebud------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Hapgood----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
119*:												
Rock outcrop.												
120*:												
Sebud	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Rochester	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Rock outcrop.												
121, 122 Shadow	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
123*, 124*:												
Shadow very channery sandy loam	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Shadow stony loam	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
125*:												
Shadow	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Mikesell	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Worock	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
126 Shedhorn	D	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
127*:												
Shedhorn	D	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Garlet	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Rock outcrop.												
128*:												
Shedhorn	D	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Rock outcrop.												
129*:												
Shurley	A	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Rentsac	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
Rock outcrop.												

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
130*:												
Shurley----------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Rock outcrop.												
131, 132---------- Thess	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
133*:												
Thess------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Amesha-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
134, 135---------- Tiban	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
136*:												
Tiban------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Rock outcrop.												
137--------------- Tineman	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
138*:												
Tineman----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Earcree----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
139, 140, 141----- Trimad	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
142*:												
Trimad-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Kalsted----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
143--------------- Trudau	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	High.
144--------------- Trudau	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
145, 146. Ustic Torriorthents												
147, 148, 149----- Varney	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
150----------------Villy	D	Occasional	Brief-----	Mar-Apr	1.0-1.5	Apparent	May-Aug	>60	---	High-----	High-----	Low.
151----------------Villy	B	Rare--------	Brief-----	Mar-Apr	3.0-5.0	Apparent	May-Aug	>60	---	High-----	High-----	Low.
152*:												
Whitecow---------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Rock outcrop.												
153*:												
Whitore channery loam------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Whitore stony loam------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
154*:												
Whitore----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Mikesell---------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Rock outcrop.												
155*:												
Whitore channery loam------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Whitore stony loam------------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Rock outcrop.												
156----------------Woodhall	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Low.
157*:												
Woodhall---------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Low.
Blaine-----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Low.
Hapgood----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
158----------------Worock	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
159*:												
Worock-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.

See footnote at end of table.

TABLE 14.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
159*:												
Mikesell----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
160---------------- Yetull	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Adel	Fine-loamy, mixed Pachic Cryoborolls
Amesha	Coarse-loamy, mixed Borollic Calciorthids
Amsterdam	Fine-silty, mixed Typic Haploborolls
Armitage	Fine-loamy over sandy or sandy-skeletal, mixed Borollic Natrargids
Attewan	Fine-loamy over sandy or sandy-skeletal, mixed Aridic Argiborolls
Bearmouth	Sandy-skeletal, mixed Typic Cryoborolls
Beaverell	Loamy-skeletal, mixed Aridic Argiborolls
Blackhall	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents
Blaine	Loamy-skeletal, mixed Argic Cryoborolls
Branham	Coarse-loamy, mixed Typic Cryoborolls
Bridger*	Fine, mixed Argic Cryoborolls
Brocko	Coarse-silty, mixed Borollic Calciorthids
Brocko Variant	Fine-silty, mixed (calcareous), frigid Typic Ustorthents
Bullrey	Fine-loamy, mixed Pachic Cryoborolls
Burnette	Fine, montmorillonitic Argic Pachic Cryoborolls
Comad	Sandy-skeletal, mixed Typic Cryorthents
Crago	Loamy-skeletal, carbonatic Borollic Calciorthids
Earcree	Coarse-loamy, mixed Pachic Cryoborolls
Garlet	Loamy-skeletal, mixed Typic Cryochrepts
Gaylord	Fine, montmorillonitic Boralfic Cryoborolls
Hanson	Loamy-skeletal, carbonatic Calcic Cryoborolls
Hapgood	Loamy-skeletal, mixed Pachic Cryoborolls
Havre	Fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents
Kalsted	Coarse-loamy, mixed Borollic Calciorthids
Larry Variant	Fine-loamy, mixed, frigid Histic Haplaquolls
Leavitt	Fine-loamy, mixed Argic Cryoborolls
Libeg	Loamy-skeletal, mixed Argic Cryoborolls
Loberg	Clayey-skeletal, mixed Typic Cryoboralfs
MacFarlane	Loamy-skeletal, mixed Typic Cryoboralfs
Marias	Fine, montmorillonitic, frigid Udorthentic Chromusterts
Maxville	Fine-loamy over sandy or sandy-skeletal, mixed Typic Cryoborolls
Mikesell	Fine, montmorillonitic Typic Cryoboralfs
Musselshell	Coarse-loamy, carbonatic Borollic Calciorthids
Neen	Fine-silty, mixed, frigid Aquic Calciorthids
Nuley	Fine-loamy, mixed Aridic Argiborolls
Oro Fino	Fine-loamy, mixed Argic Cryoborolls
Pensore	Loamy-skeletal, carbonatic Borollic Lithic Calciorthids
Poin	Loamy-skeletal, mixed Lithic Cryoborolls
Raynesford	Fine-loamy, carbonatic Calcic Cryoborolls
Redchief Variant	Clayey-skeletal, mixed Argic Cryoborolls
Rentsac	Loamy-skeletal, mixed (calcareous), frigid Lithic Ustic Torriorthents
Rivra	Sandy-skeletal, mixed, frigid Ustic Torrifluvents
Rochester	Sandy-skeletal, mixed, frigid Typic Ustorthents
Ryell	Coarse-loamy over sandy or sandy-skeletal, mixed (calcareous), frigid Ustic Torrifluvents
Saunders	Fine-silty, frigid Aeric Calciaquolls
Scravo	Sandy-skeletal, mixed Borollic Calciorthids
Sebud*	Loamy-skeletal, mixed Typic Cryoborolls
Shadow	Loamy-skeletal, mixed Typic Cryochrepts
Shedhorn	Fine, mixed Typic Cryoborolls
Shurley	Sandy-skeletal, mixed Borollic Camborthids
Thess**	Fine-loamy over sandy or sandy-skeletal, mixed Borollic Calciorthids
Tiban	Loamy-skeletal, mixed Typic Cryoborolls
Tineman	Loamy-skeletal, mixed Typic Cryoborolls
Trimad	Loamy-skeletal, mixed Aridic Calciborolls
Trudau	Fine-loamy, mixed Borollic Camborthids
Varney	Fine-loamy, mixed Aridic Argiborolls
Villy	Fine-silty, mixed (calcareous), frigid Typic Fluvaquents
Whitecow	Loamy-skeletal, carbonatic, frigid Typic Ustochrepts
Whitore	Loamy-skeletal, carbonatic Typic Cryochrepts
Woodhall	Loamy-skeletal, mixed Argic Cryoborolls

See footnotes at end of table.

TABLE 15.--CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
Worock	Loamy-skeletal, mixed Typic Cryoboralfs
Yetull	Mixed, frigid Ustic Torripsamments

* Some of the Bridger and Sebud soils are taxadjuncts to the series. See text for a description of those characteristics of the soils that are outside the range of the series.

** All of the Thess soils are taxadjuncts to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

*U.S. G.P.O. 1990-256-634

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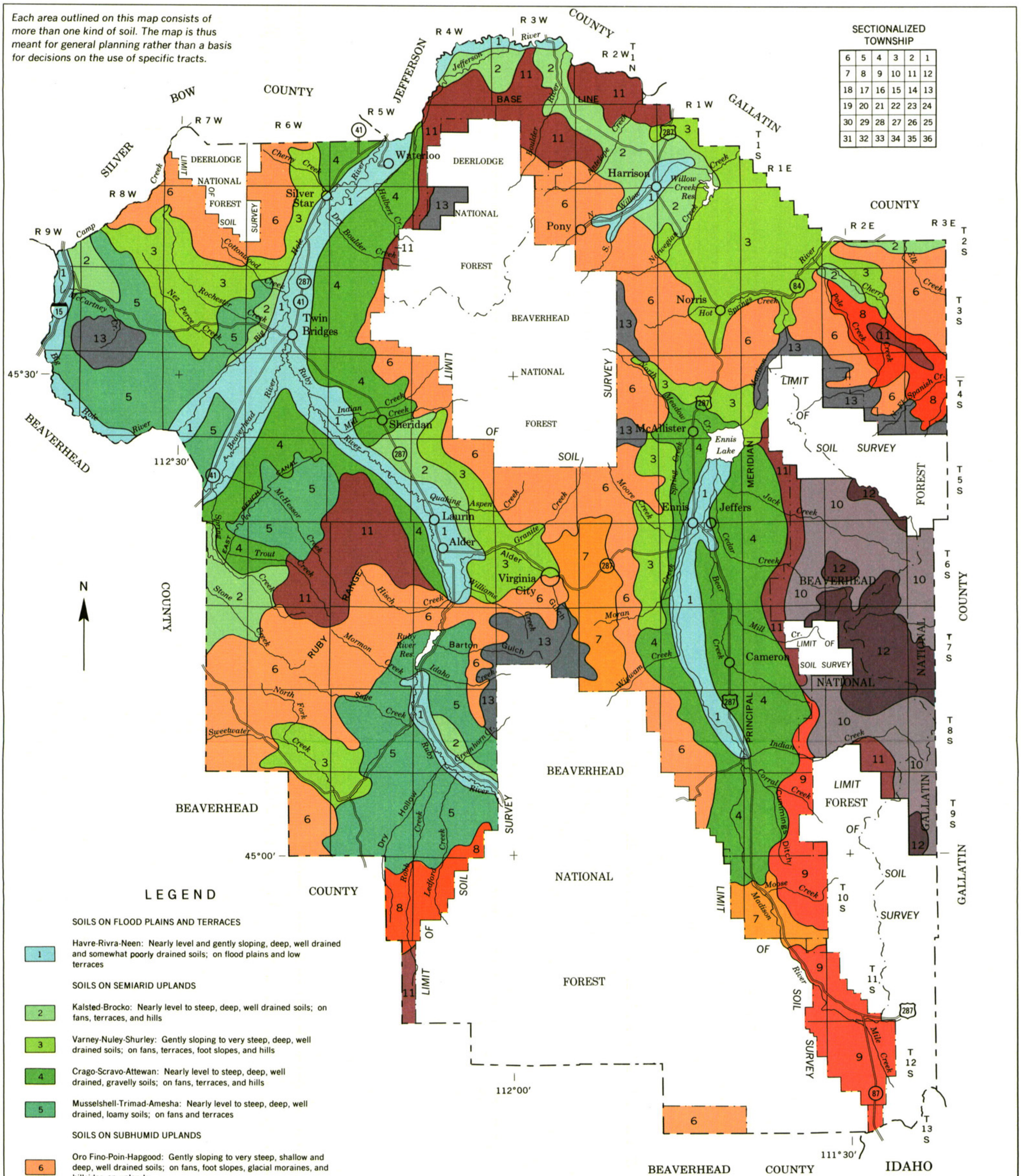


LEGEND

SOILS ON FLOOD PLAINS AND TERRACES

1 — Havre-Rivra-Neen: Nearly level and gently sloping, deep, well drained and somewhat poorly drained soils; on flood plains and low terraces

SOILS ON SEMIARID UPLANDS

2 — Kalsted-Brocko: Nearly level to steep, deep, well drained soils; on fans, terraces, and hills

3 — Varney-Nuley-Shurley: Gently sloping to very steep, deep, well drained soils; on fans, terraces, foot slopes, and hills

4 — Crago-Scravo-Attewan: Nearly level to steep, deep, well drained, gravelly soils; on fans, terraces, and hills

5 — Musselshell-Trimad-Amesha: Nearly level to steep, deep, well drained, loamy soils; on fans and terraces

SOILS ON SUBHUMID UPLANDS

6 — Oro Fino-Poin-Hapgood: Gently sloping to very steep, shallow and deep, well drained soils; on fans, foot slopes, glacial moraines, and hillsides on uplands

7 — Woodhall-Libeg-Hapgood: Gently sloping to very steep, moderately deep and deep, well drained soils; on fans, foot slopes, glacial moraines, benches, and hills

8 — Bridger-Hanson: Gently sloping to steep, deep, well drained soils; on fans, foot slopes, glacial moraines, and hillsides

9 — Leavitt-Maxville-Bearmouth: Nearly level to moderately steep, deep, well drained soils; on terraces, fans, and foot slopes on uplands

SOILS ON MOUNTAINS

10 — Mikesell-Shadow-Worock: Strongly sloping to very steep, deep, well drained and somewhat excessively drained soils; on mountain slopes, foot slopes, glacial moraines, and terraces

11 — Whitore-Hanson-Rock outcrop: Gently sloping to very steep, deep, well drained soils, and Rock outcrop; on foot slopes, mountain slopes, glacial moraines, and hillsides

12 — Rock outcrop-Garlet: Rock outcrop and strongly sloping to very steep, deep, well drained soils; on mountain slopes and glacial moraines

13 — Shadow-Rochester-MacFarlane: Moderately sloping to very steep, deep, well drained, somewhat excessively drained, and excessively drained soils; on mountain slopes, hillsides, and glacial moraines

COMPILED 1986

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MONTANA AGRICULTURAL EXPERIMENT STATION

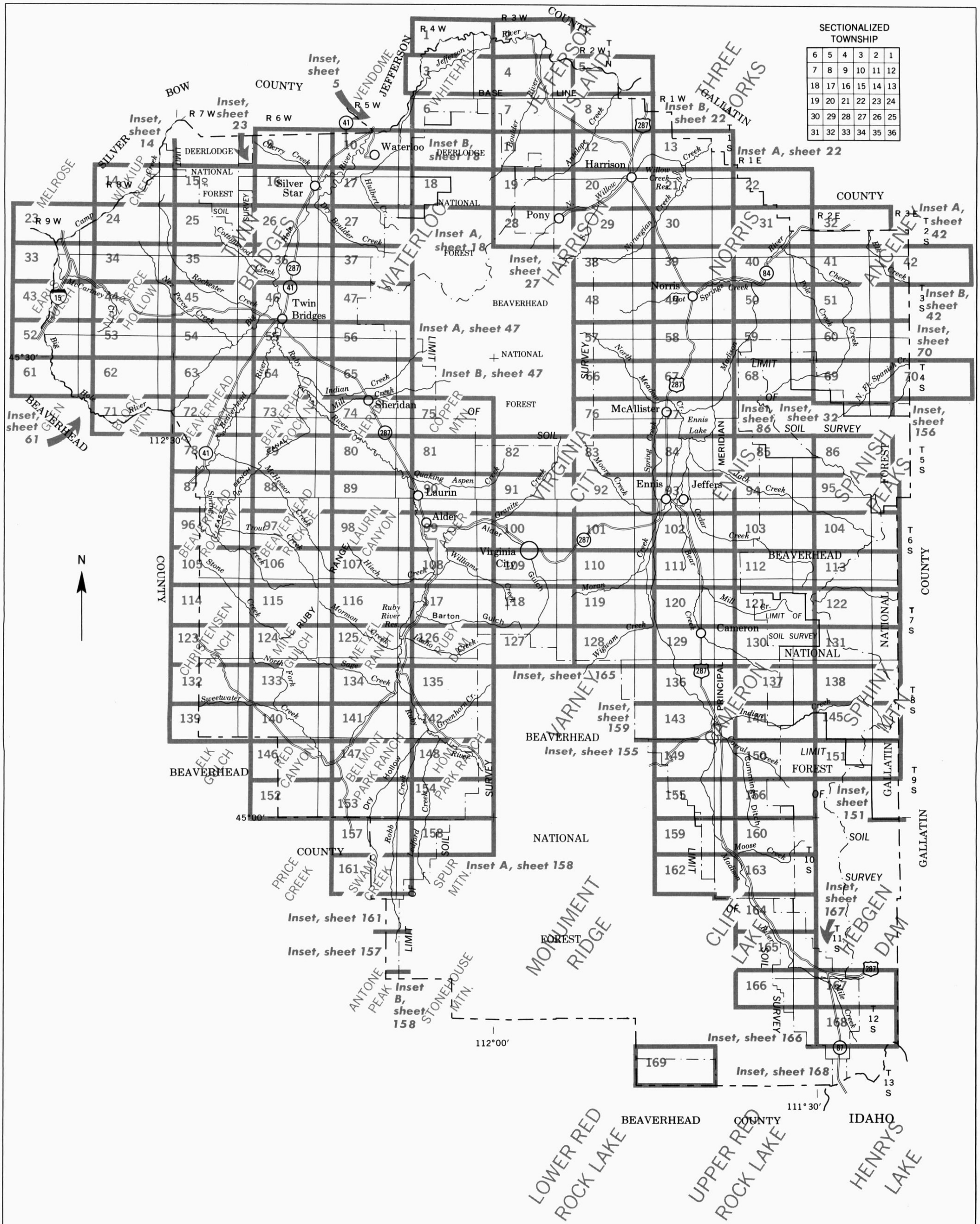
GENERAL SOIL MAP

MADISON COUNTY AREA, MONTANA

Scale 1:443,520

1 0 1 2 3 4 5 6 7 Miles

0 7 14 Km



INDEX TO MAP SHEETS

MADISON COUNTY AREA, MONTANA

Scale 1:443,520

1 0 1 2 3 4 5 6 7 Miles

0 7 14 Km

Original text from each individual map sheet read:
Coordinate grid ticks and land division corners, if shown, are approximately positioned. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1975, 1976, and 1977 aerial photography. This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

SOIL LEGEND

SYMBOL	NAME
1	Adel loam, 0 to 4 percent slopes
2	Adel loam, 4 to 15 percent slopes
3	Amesha loam, cool, 2 to 8 percent slopes
4	Amesha loam, cool, bedrock substratum, 8 to 25 percent slopes
5	Amesha, bedrock substratum-Musselshell complex, cool, 2 to 8 percent slopes
6	Amsterdam silty clay loam, 2 to 8 percent slopes
7	Amsterdam-Brocko Variant complex, 8 to 15 percent slopes
8	Aquic Cryoboralfs-Typic Cryochrepts complex, 4 to 15 percent slopes
9	Armitage-Thess, cool, complex, 0 to 4 percent slopes
10	Attewan loam, cool, 0 to 2 percent slopes
11	Attewan loam, cool, 2 to 8 percent slopes
12	Attewan cobbly loam, cool, 2 to 8 percent slopes
13	Attewan very stony loam, cool, 2 to 8 percent slopes
14	Badland
15	Bearmouth gravelly loam, 2 to 8 percent slopes
16	Bearmouth extremely stony loam, 0 to 4 percent slopes
17	Beaverell cobbly loam, cool, 0 to 6 percent slopes
18	Blackhall-Rock outcrop complex, 15 to 45 percent slopes
19	Blaine stony loam, 2 to 15 percent slopes
20	Borohemists, nearly level
21	Branham coarse sandy loam, 2 to 8 percent slopes
22	Branham-Rock outcrop complex, 8 to 45 percent slopes
23	Bridger clay loam, 2 to 8 percent slopes
24	Bridger cobbly clay loam, 8 to 35 percent slopes
25	Bridger-Cryaquolls complex, 2 to 25 percent slopes
26	Bridger-Tiban-Adel complex, 8 to 25 percent slopes
27	Brocko silt loam, cool, 0 to 2 percent slopes
28	Brocko silt loam, cool, 2 to 12 percent slopes
29	Brocko-Crago complex, cool, 8 to 45 percent slopes
30	Brocko Variant silt loam, 2 to 12 percent slopes
31	Bullrey loam, bedrock substratum, 2 to 12 percent slopes
32	Comad-Earcree complex, 8 to 45 percent slopes
33	Crago gravelly loam, cool, 0 to 8 percent slopes
34	Crago gravelly loam, cool, rolling
35	Crago very stony loam, cool, 2 to 45 percent slopes
36	Crago, cool-Kalsted-Pensore complex, 8 to 45 percent slopes
37	Crago-Scravo complex, cool, 15 to 45 percent slopes
38	Cryaquolls, nearly level
39	Cryoborolls, strongly sloping
40	Cryorthents, steep
41	Earcree sandy loam, 2 to 8 percent slopes
42	Earcree gravelly sandy loam, dry, 2 to 8 percent slopes
43	Earcree gravelly sandy loam, slightly wet, 8 to 35 percent slopes
44	Earcree, dry-Branham-Rock outcrop complex, 35 to 60 percent slopes
45	Fluvaquentic Haplaquolls, nearly level
46	Garlet very channery sandy loam, cool, 15 to 45 percent slopes
47	Garlet, cool-Rock outcrop complex, 45 to 70 percent slopes
48	Gaylord-Burnette complex, 4 to 15 percent slopes
49	Hanson channery loam, 2 to 8 percent slopes
50	Hanson channery loam, 8 to 45 percent slopes
51	Hanson-Adel complex, 4 to 45 percent slopes
52	Hanson-Raynesford complex, 8 to 35 percent slopes
53	Hanson-Rock outcrop complex, 25 to 45 percent slopes
54	Hapgood loam, moist, 2 to 8 percent slopes
55	Hapgood loam, moist, 8 to 25 percent slopes
56	Hapgood very stony loam, 4 to 15 percent slopes
57	Hapgood-Sebud very stony loams, 15 to 45 percent slopes
58	Havre loam, cool, 0 to 2 percent slopes
59	Havre loam, cool, wet, 0 to 2 percent slopes
60	Kalsted loamy sand, 2 to 8 percent slopes
61	Kalsted sandy loam, 0 to 2 percent slopes
62	Kalsted sandy loam, 2 to 8 percent slopes
63	Kalsted sandy loam, 8 to 15 percent slopes
64	Kalsted gravelly sandy loam, 15 to 35 percent slopes
65	Larry Variant peat, 0 to 2 percent slopes
66	Leavitt loam, moist, 2 to 15 percent slopes
67	Leavitt cobbly loam, 2 to 8 percent slopes
68	Leavitt stony loam, 2 to 25 percent slopes
69	Leavitt, moist-Adel complex, 4 to 15 percent slopes
70	Libeg-Adel complex, 4 to 25 percent slopes
71	Libeg-Hapgood complex, 15 to 45 percent slopes
72	Loberg very stony loam, 15 to 45 percent slopes
73	MacFarlane stony sandy loam, 15 to 45 percent slopes
74	MacFarlane very stony sandy loam, warm, 15 to 45 percent slopes
75	Marias silty clay loam, cool, 2 to 8 percent slopes
76	Maxville gravelly loam, 2 to 8 percent slopes
77	Maxville cobbly loam, dry, 2 to 8 percent slopes
78	Maxville, dry-Bearmouth complex, 0 to 8 percent slopes
79	Maxville-Bearmouth complex, rarely flooded, 0 to 4 percent slopes
80	Mikesell clay loam, 15 to 45 percent slopes
81	Mikesell clay loam, 45 to 60 percent slopes
82	Musselshell loam, cool, 2 to 8 percent slopes
83	Musselshell gravelly loam, cool, 0 to 2 percent slopes
84	Musselshell-Amesha, bedrock substratum, complex, cool, 8 to 25 percent slopes
85	Musselshell-Crago complex, cool, 2 to 8 percent slopes
86	Neen silty clay loam, 0 to 2 percent slopes
87	Neen silty clay loam, drained, 0 to 2 percent slopes
88	Neen silty clay loam, wet, 0 to 2 percent slopes
89	Nuley sandy loam, 2 to 12 percent slopes
90	Nuley clay loam, 2 to 8 percent slopes
91	Nuley-Rock outcrop complex, 8 to 35 percent slopes
92	Oro Fino loam, 2 to 12 percent slopes
93	Oro Fino-Poin complex, 4 to 15 percent slopes
94	Oro Fino-Poin complex, 15 to 45 percent slopes
95	Pensore-Crago, cool-Rock outcrop complex, 25 to 75 percent slopes
96	Pits, gravel
97	Poin-Earcree, dry, complex, 45 to 60 percent slopes
98	Poin-Rock outcrop complex, 4 to 15 percent slopes
99	Poin-Sebud complex, 8 to 45 percent slopes
100	Raynesford loam, 2 to 8 percent slopes
101	Redchief-Variant-Hapgood, moist, complex, 8 to 25 percent slopes
102	Rentsac very channery loam, 45 to 75 percent slopes
103	Rentsac-Kalsted complex, 8 to 25 percent slopes
104	Rentsac-Varney complex, 8 to 45 percent slopes
105	Rivra very gravelly sandy loam, cool, 2 to 4 percent slopes
106	Rivra, cool-Fluvaquents complex, 0 to 2 percent slopes
107	Rivra-Ryell-Havre complex, cool, 0 to 2 percent slopes
108	Rochester-Rock outcrop complex, 35 to 70 percent slopes
109	Rock outcrop-Cryoborolls-Cryochrepts complex, very steep
110	Ryell-Rivra complex, cool, 0 to 2 percent slopes
111	Ryell-Rivra sandy loams, cool, saline, 0 to 2 percent slopes
112	Saunders silty clay loam, 0 to 2 percent slopes
113	Saunders silty clay loam, reclaimed, 0 to 2 percent slopes
114	Scravo sandy loam, cool, 2 to 8 percent slopes
115	Scravo very cobbly sandy loam, cool, 0 to 4 percent slopes
116	Scravo-Crago complex, cool, 2 to 8 percent slopes
117	Scravo-Thess complex, cool, 0 to 4 percent slopes
118	Sebud-Hapgood complex, 8 to 45 percent slopes
119	Sebud-Hapgood-Rock outcrop complex, 25 to 60 percent slopes
120	Sebud-Rochester-Rock outcrop complex, 25 to 60 percent slopes
121	Shadow very channery loam, 15 to 45 percent slopes
122	Shadow very flaggy loam, 45 to 70 percent slopes
123	Shadow complex, warm, 15 to 45 percent slopes
124	Shadow complex, warm, 45 to 70 percent slopes
125	Shadow, warm-Mikesell-Worock complex, 45 to 70 percent slopes
126	Shedhorn clay loam, 8 to 25 percent slopes
127	Shedhorn, cool-Garlet, cool-Rock outcrop complex, 30 to 70 percent slopes
128	Shedhorn-Rock outcrop complex, 15 to 45 percent slopes
129	Shurley-Rentsac-Rock outcrop complex, 8 to 35 percent slopes
130	Shurley-Rock outcrop complex, 25 to 60 percent slopes
131	Thess sandy loam, cool, 2 to 4 percent slopes
132	Thess loam, cool, 2 to 8 percent slopes
133	Thess-Amesha loams, cool, 0 to 2 percent slopes
134	Tiban cobbly loam, 2 to 15 percent slopes
135	Tiban very stony loam, 15 to 45 percent slopes
136	Tiban, moist-Rock outcrop complex, 8 to 45 percent slopes
137	Tineman gravelly loam, 2 to 8 percent slopes
138	Tineman-Earcree complex, 4 to 25 percent slopes
139	Trimad cobbly loam, 2 to 8 percent slopes
140	Trimad cobbly loam, 15 to 45 percent slopes
141	Trimad very stony loam, 2 to 8 percent slopes
142	Trimad-Kalsted complex, 8 to 45 percent slopes
143	Trudau loam, 2 to 8 percent slopes
144	Trudau loam, slightly saline, 2 to 8 percent slopes
145	Ustic Torriorthents, gently sloping
146	Ustic Torriorthents, hilly
147	Varney clay loam, 2 to 8 percent slopes
148	Varney clay loam, 8 to 15 percent slopes
149	Varney cobbly clay loam, 8 to 45 percent slopes
150	Villy silty clay loam, cool, 0 to 2 percent slopes
151	Villy silty clay loam, cool, drained, 0 to 2 percent slopes
152	Whitecow-Rock outcrop complex, 25 to 70 percent slopes
153	Whitore complex, 15 to 45 percent slopes
154	Whitore-Mikesell, warm-Rock outcrop complex, 25 to 60 percent slopes
155	Whitore-Rock outcrop complex, 25 to 70 percent slopes
156	Woodhall gravelly loam, 4 to 15 percent slopes
157	Woodhall-Blaine-Hapgood complex, 4 to 25 percent slopes
158	Worock gravelly sandy loam, 8 to 35 percent slopes
159	Worock-Mikesell complex, 15 to 45 percent slopes
160	Yetull loamy sand, cool, 2 to 8 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label) — Swift Airport

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 3, 26

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

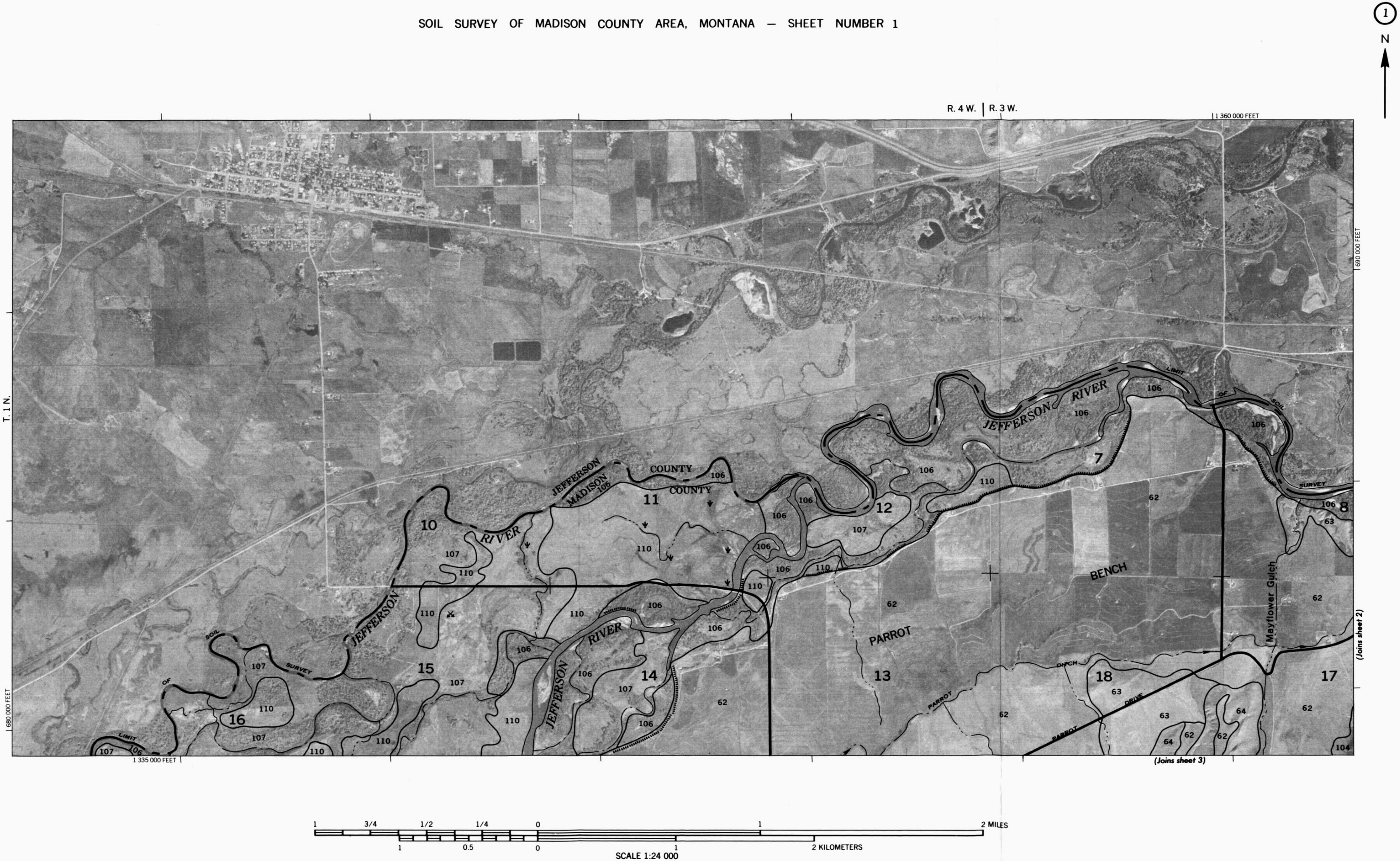
DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Ski lift
- Boulders

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 1



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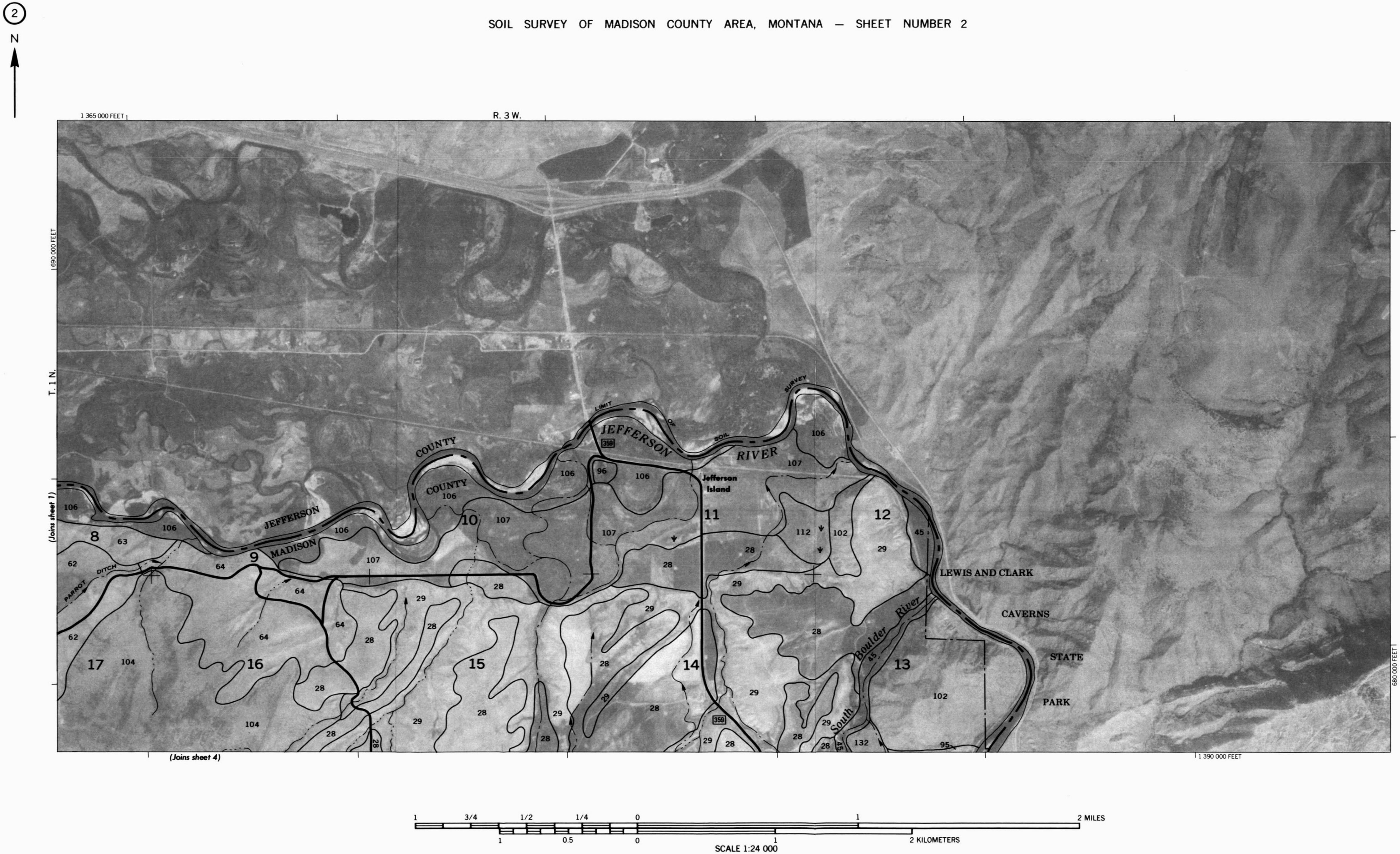

3

N

1 3/4 1/2 1/4 0 1 2 MILES

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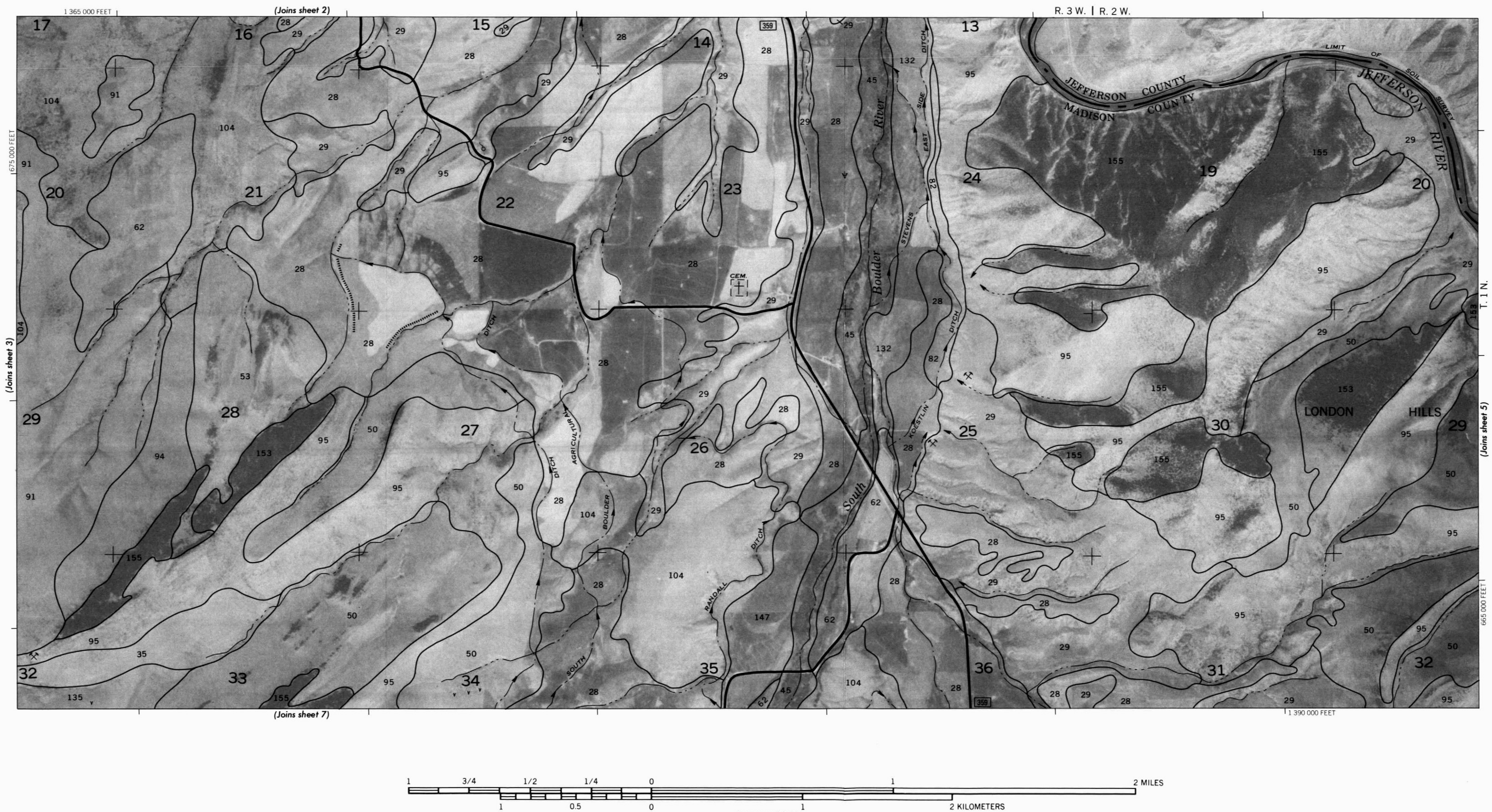
SCALE 1:24 000

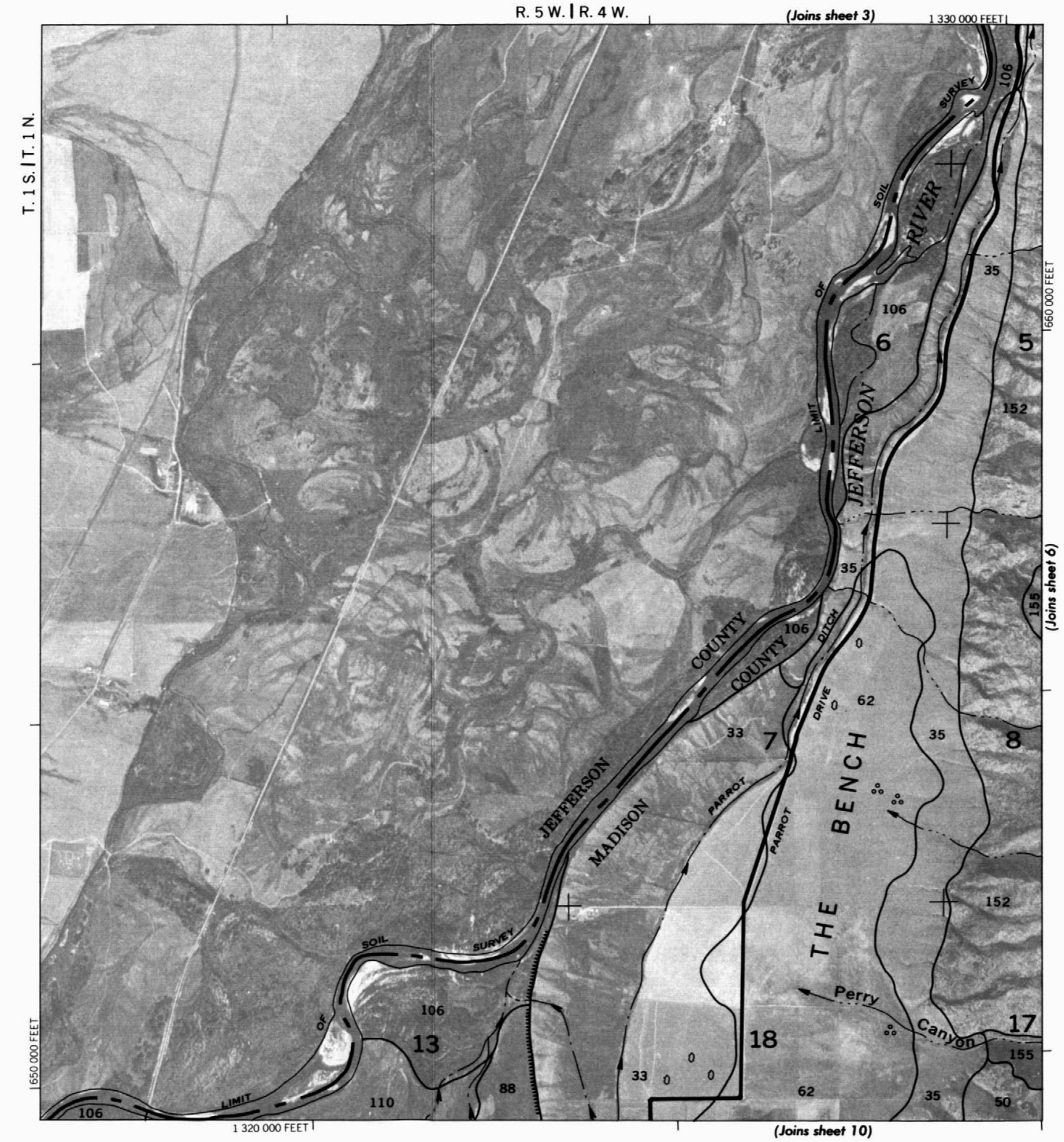
4

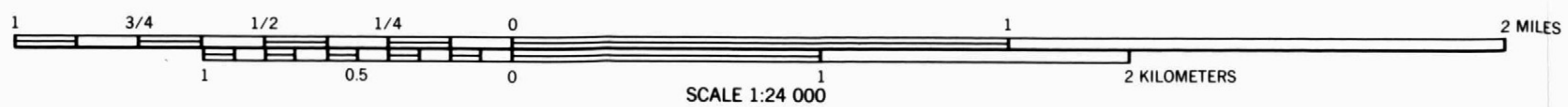
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 4



SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 5

INSET





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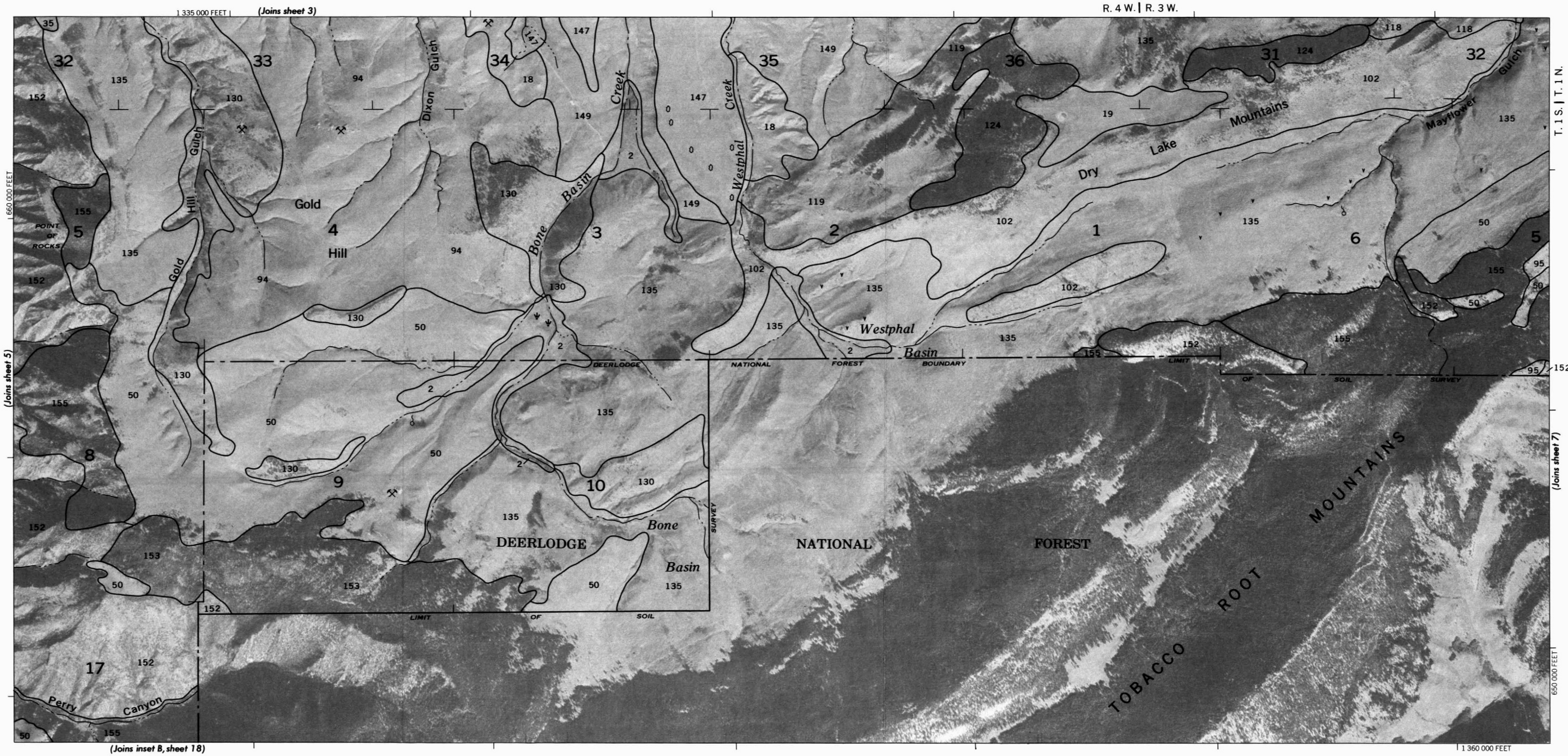

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SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 7

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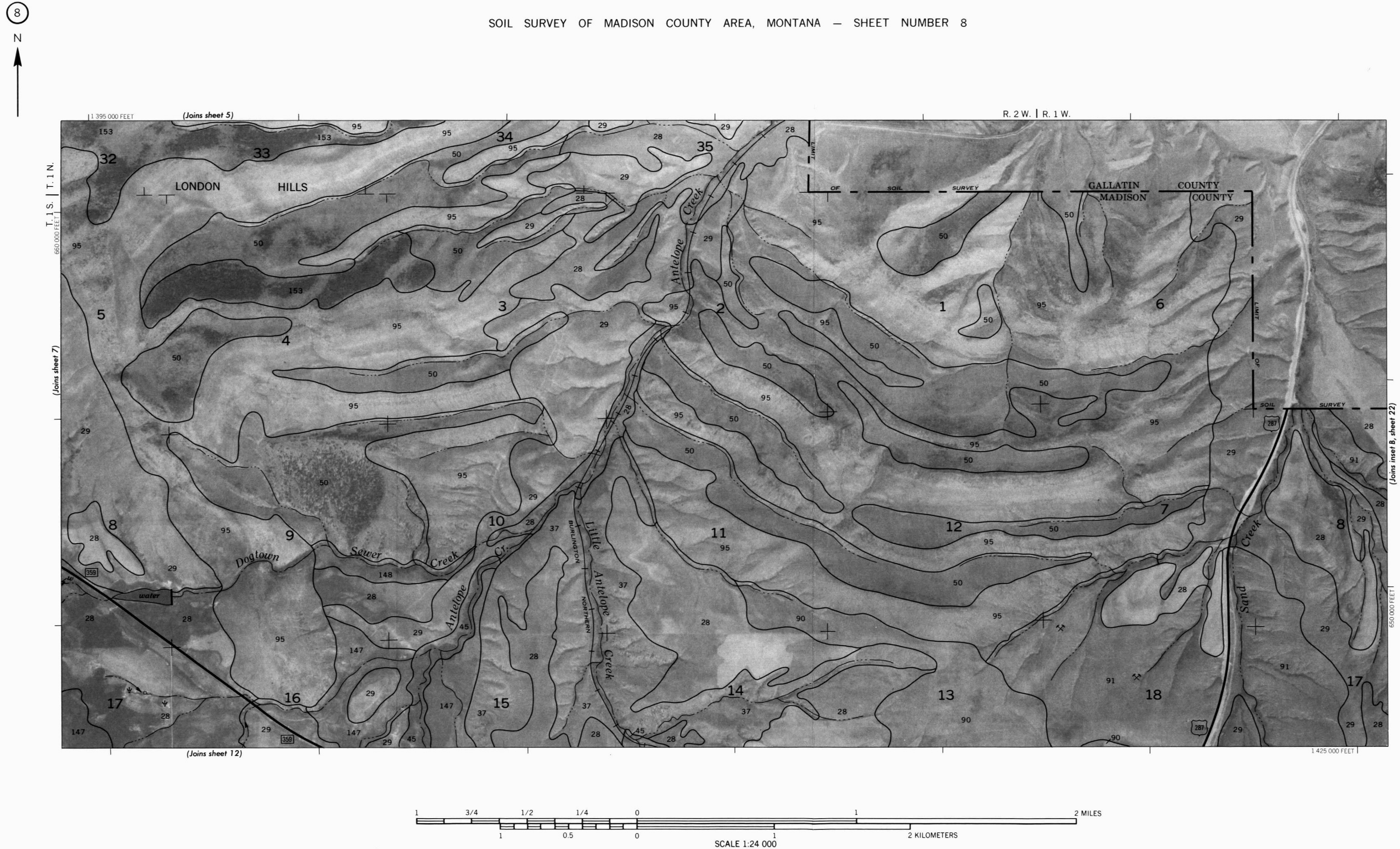

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 9

9

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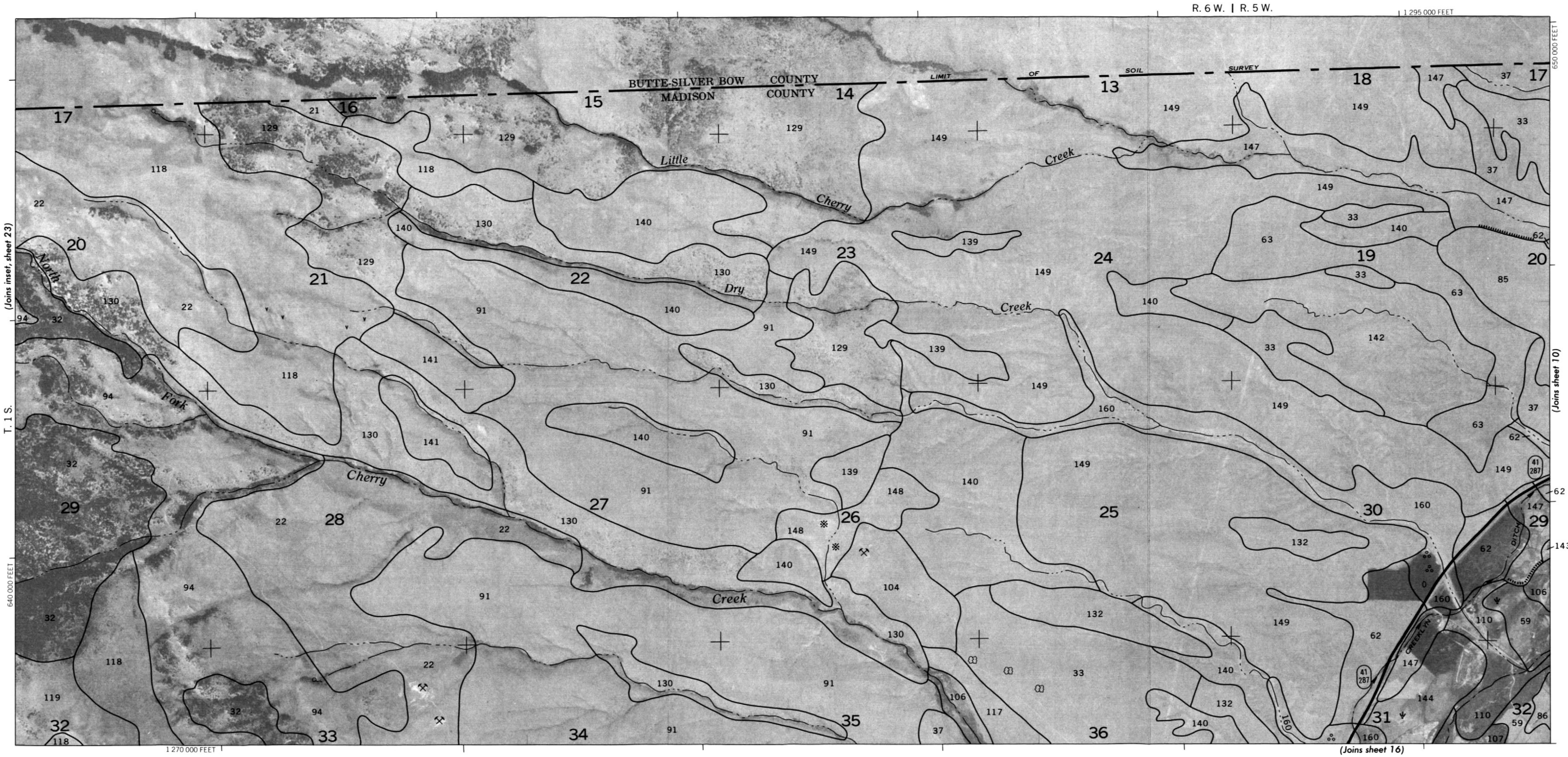

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SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 10

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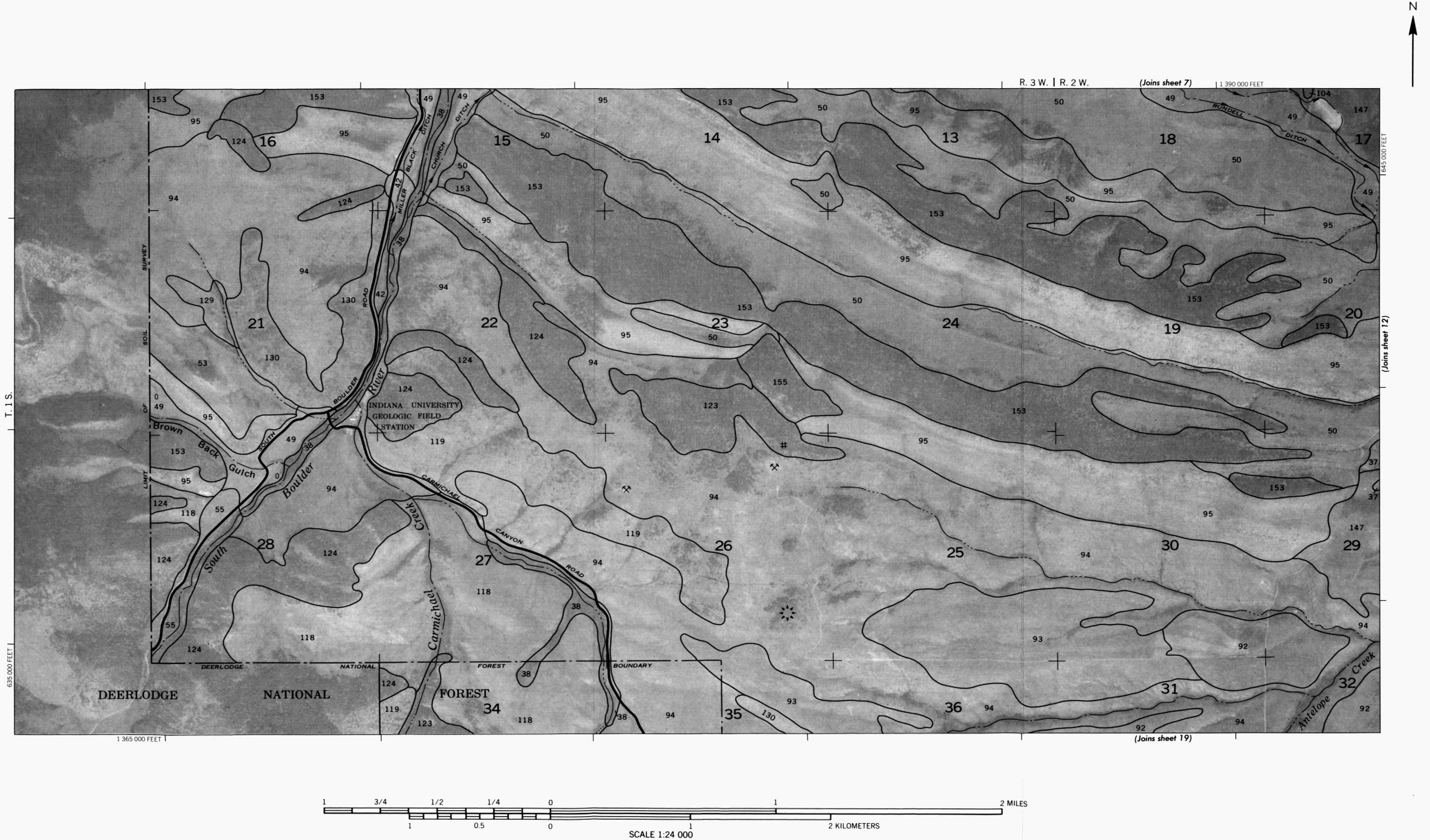
SCALE 1:24 000


11
N
R. 3 W. | R. 2 W.
(Joins sheet 7)
(Joins sheet 12)
(Joins sheet 19)
T. 1 S.
1 390 000 FEET
645 000 FEET
635 000 FEET
1 365 000 FEET
INDIANA UNIVERSITY GEOLOGIC FIELD STATION
DEERLODGE NATIONAL FOREST
DEERLODGE NATIONAL FOREST BOUNDARY
SOIL SURVEY LIMIT
Brown Back Gulch
South Boulder River
BOULDER RIVER ROAD
MILLER ROAD
BLACK DITCH
CHURCH DITCH
RUNDELL DITCH
CARMICHAEL CANYON ROAD
Carmichael Creek
Antelope Creek
1 3/4 1/2 1/4 0 1 2 MILES
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SCALE 1:24 000

12

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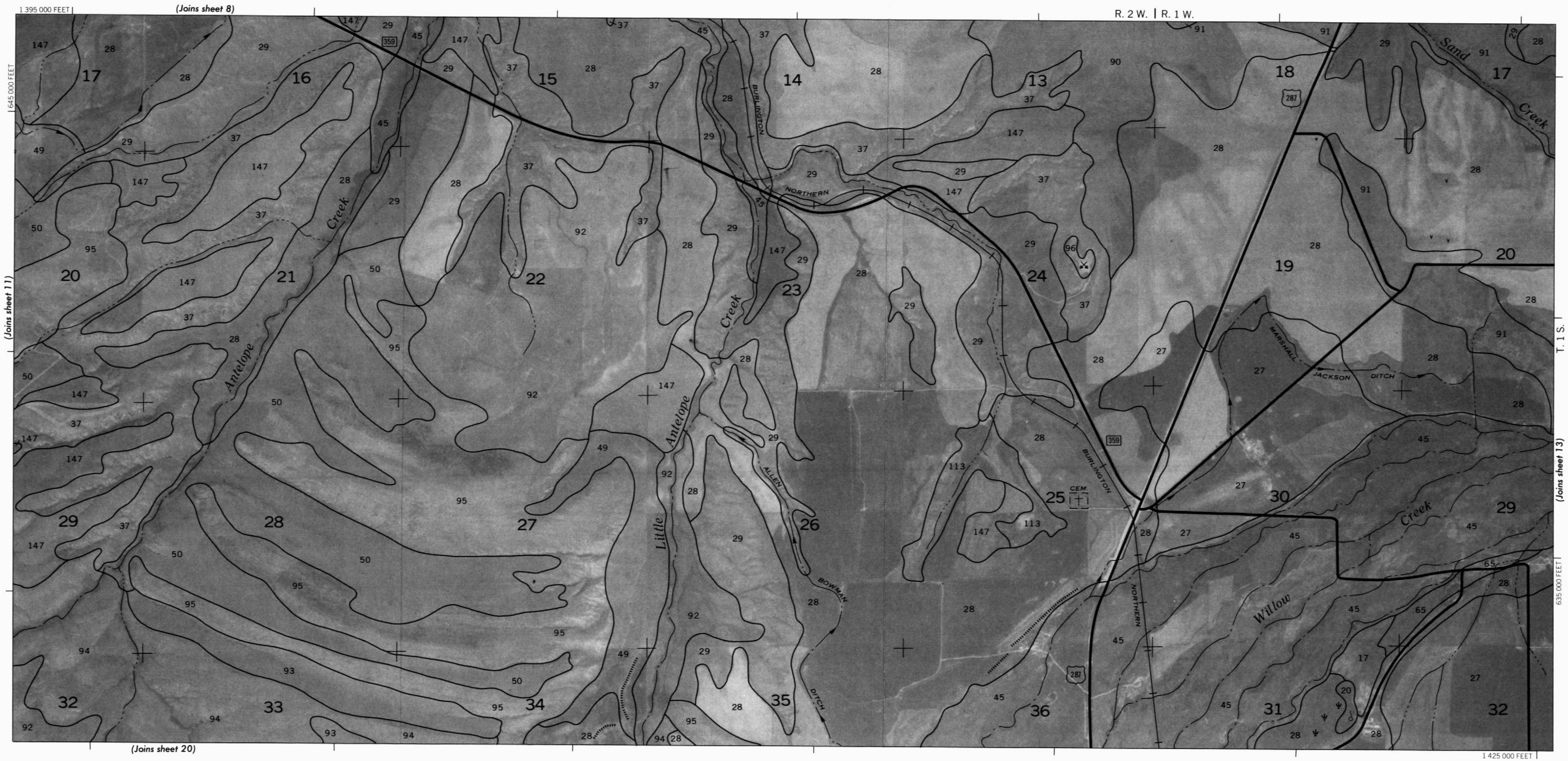
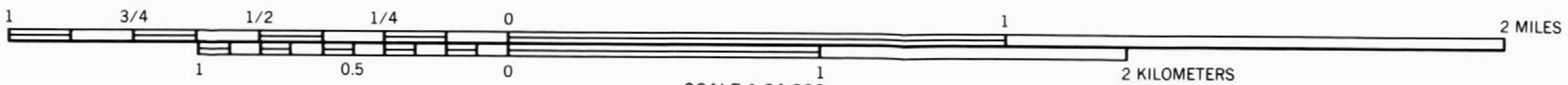
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 12





SCALE 1:24 000

13

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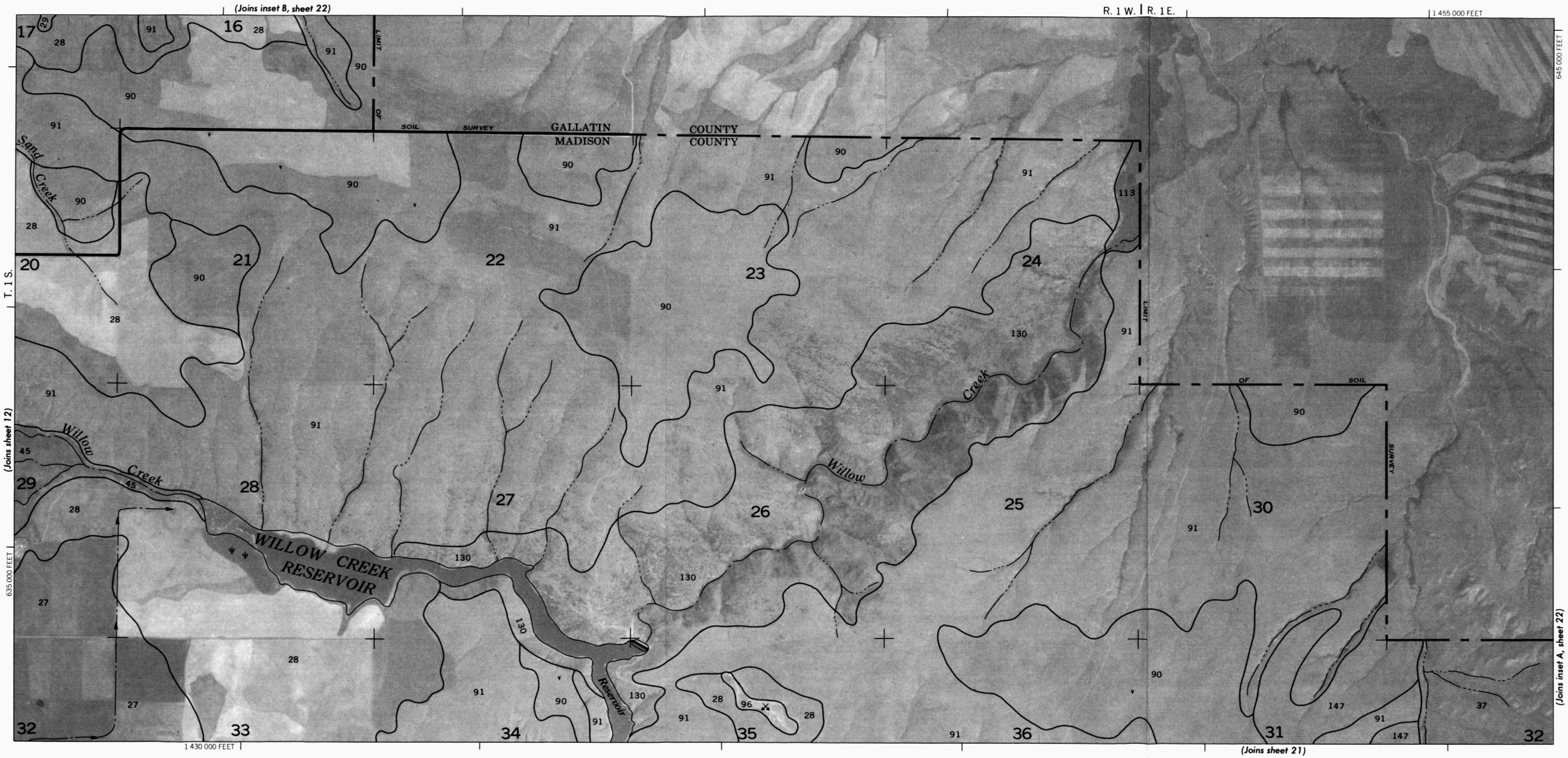

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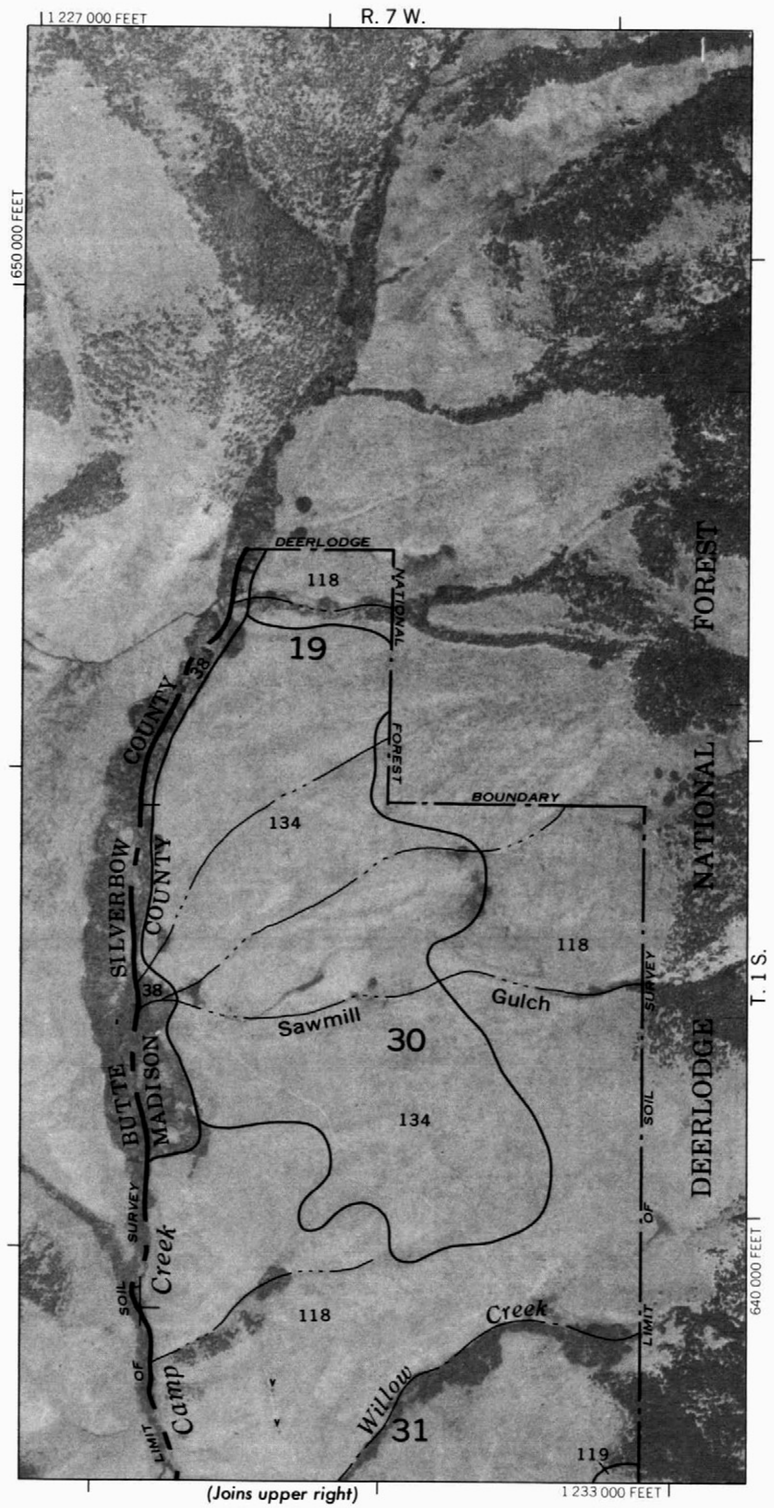
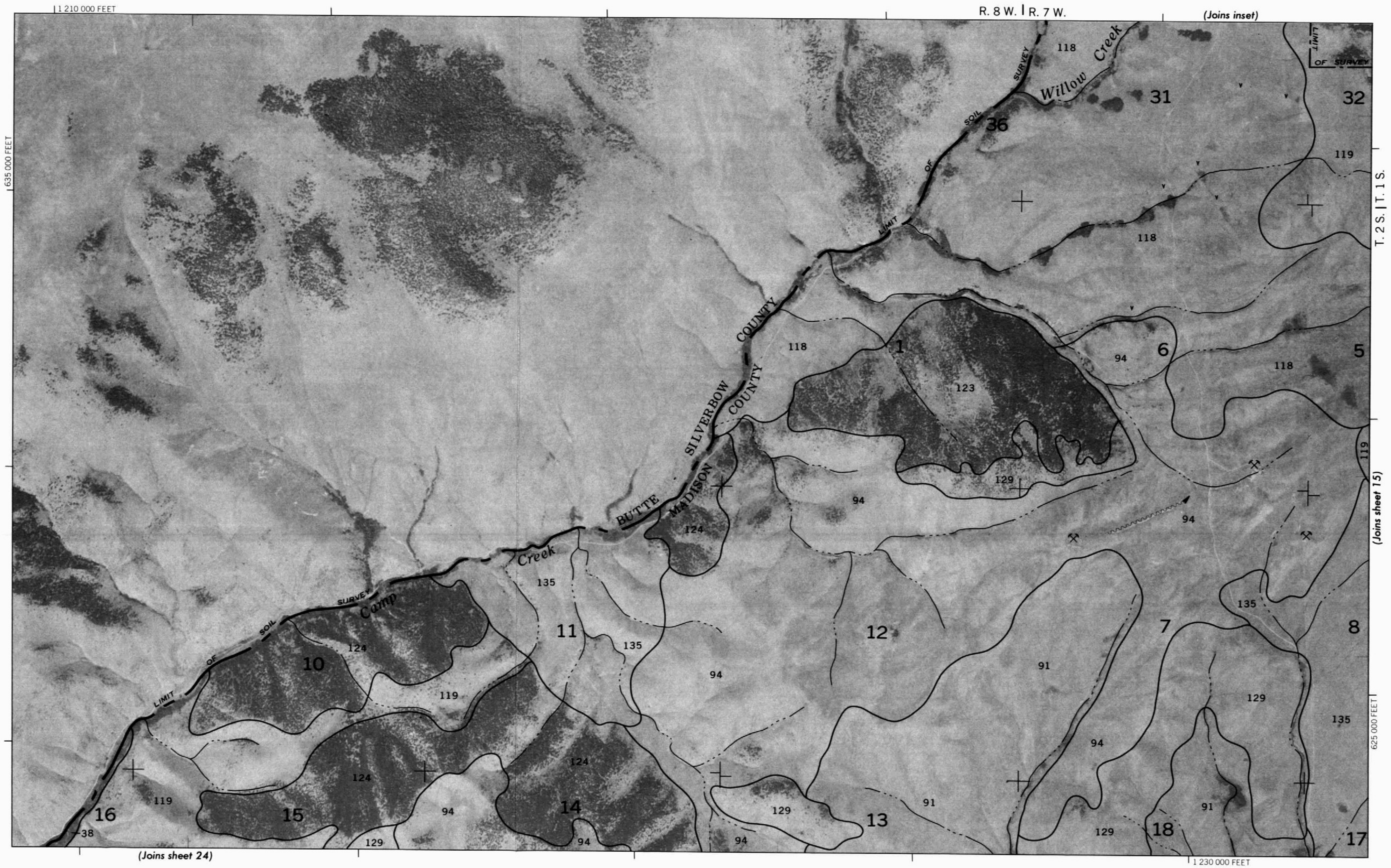
SCALE 1:24 000





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SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 15

15

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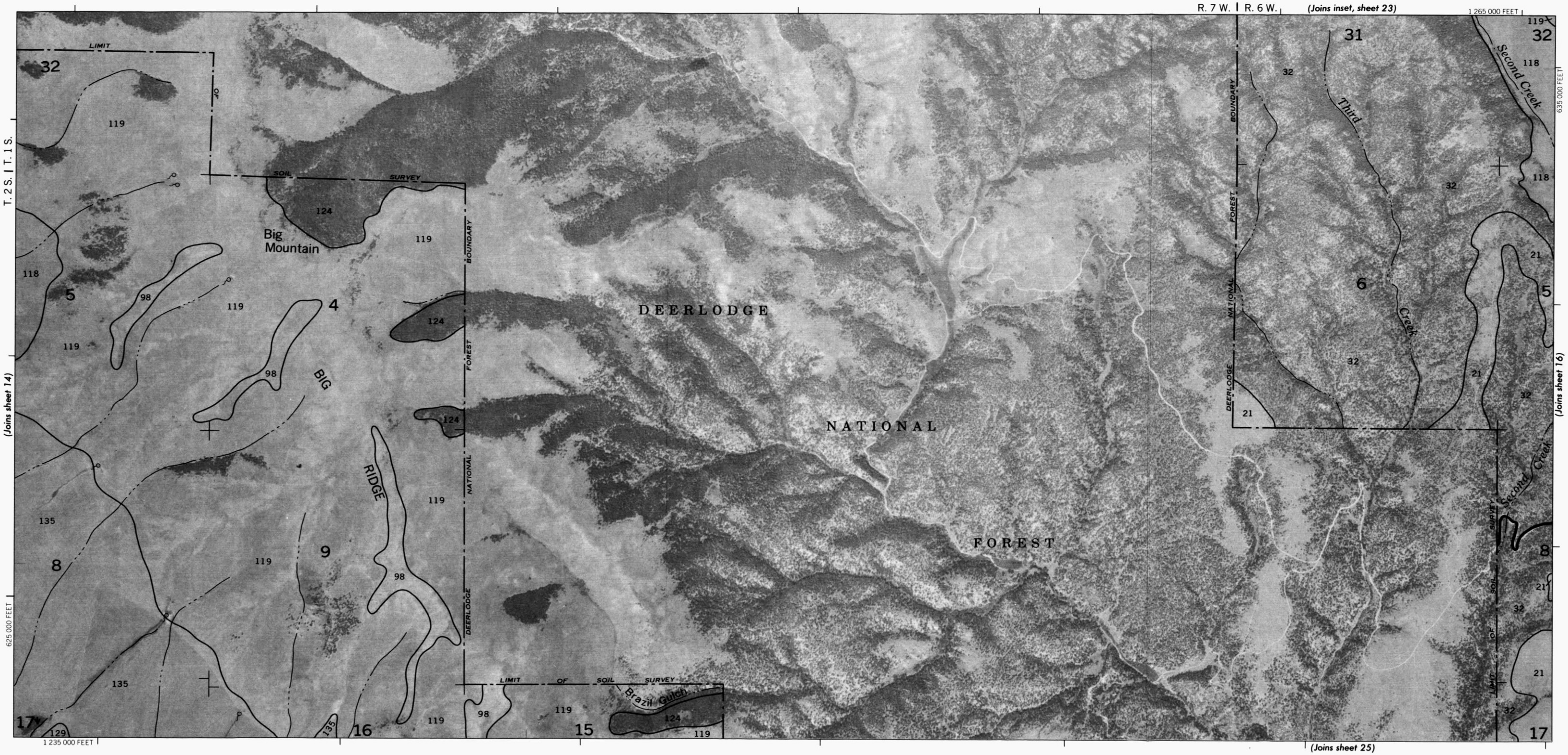

1 3/4 1/2 1/4 0 1 2 MILES

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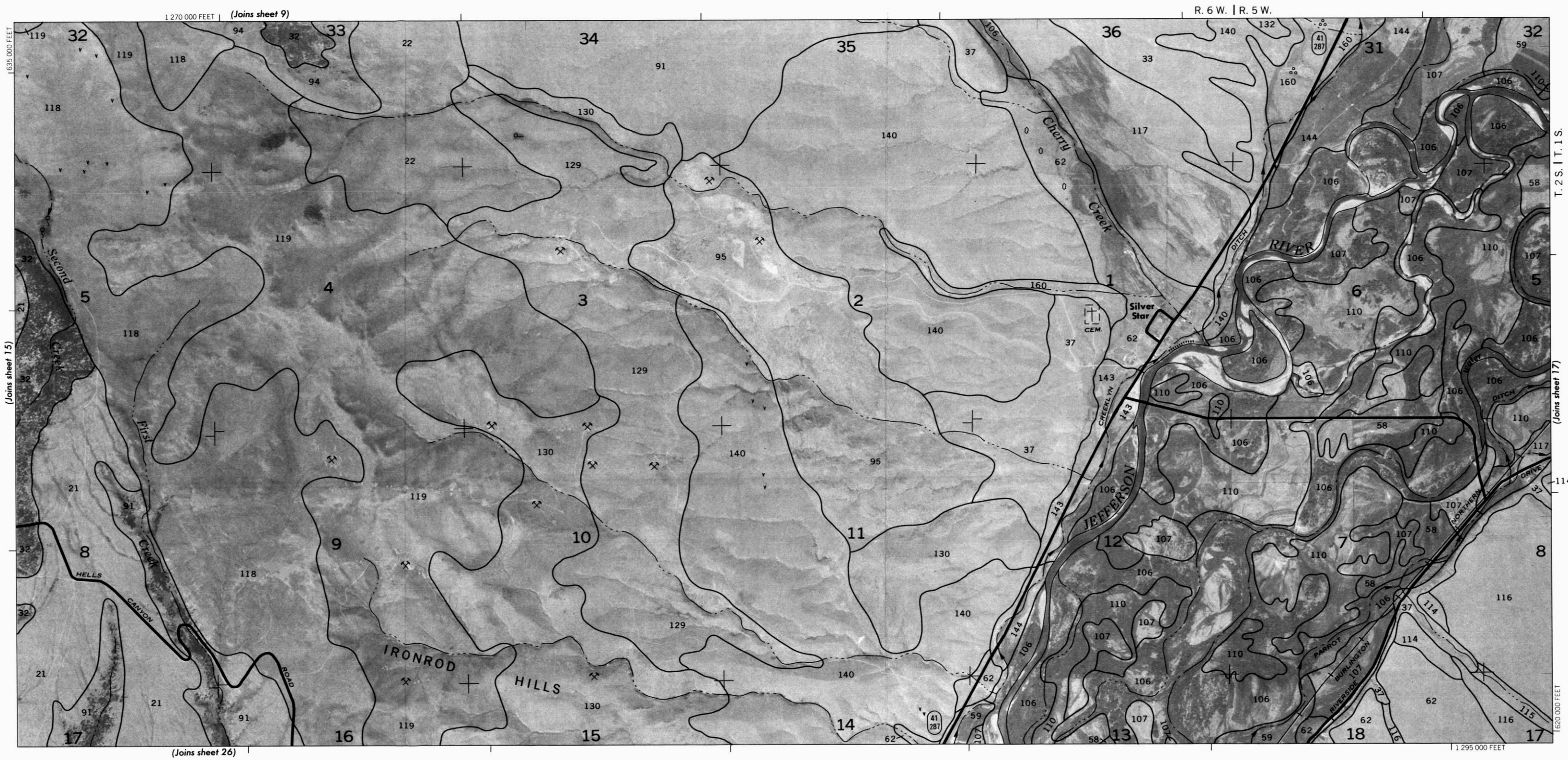
SCALE 1:24 000

16

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 16



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SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 17

18

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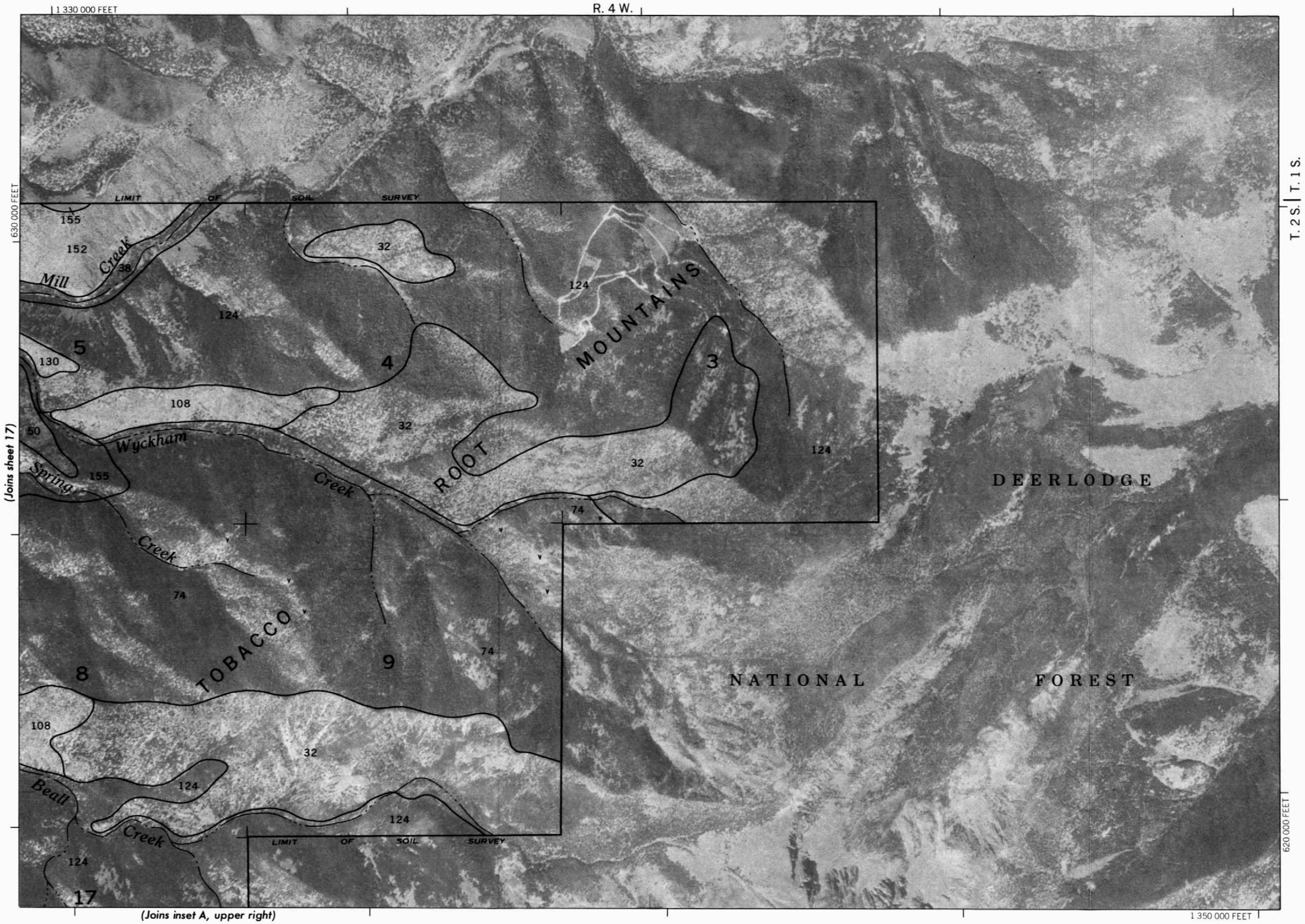
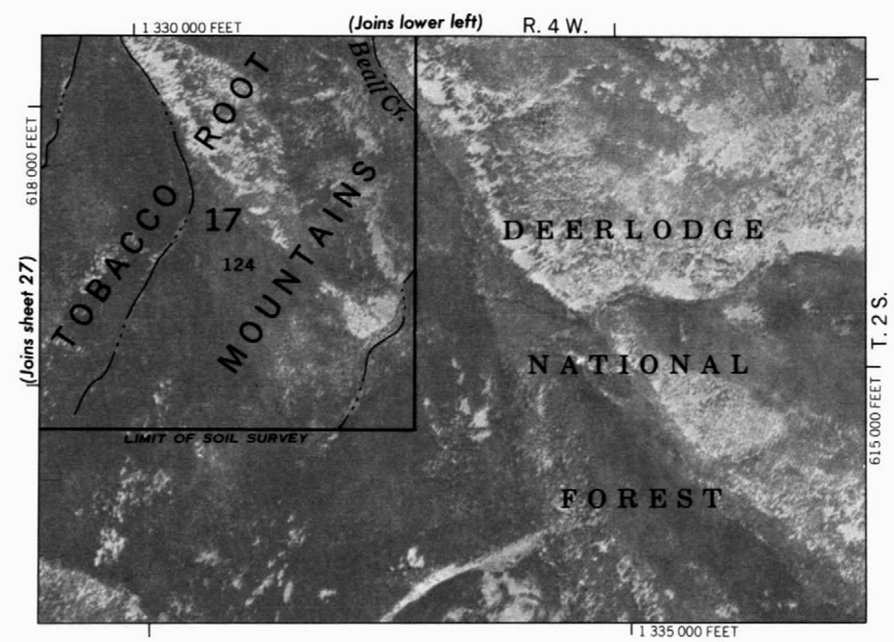
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 18

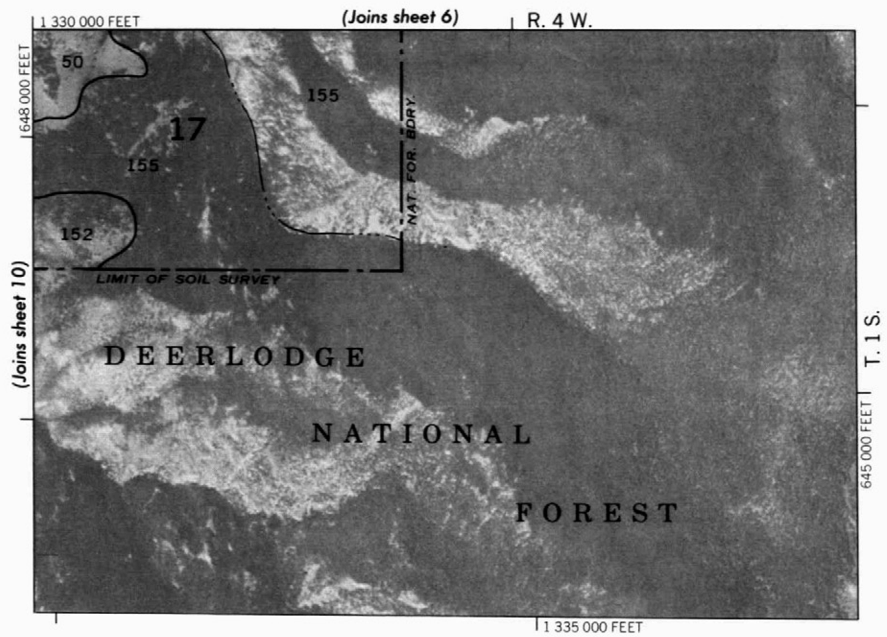


INSET A



3000 AND 5000-FOOT GRID TICKS

INSET B

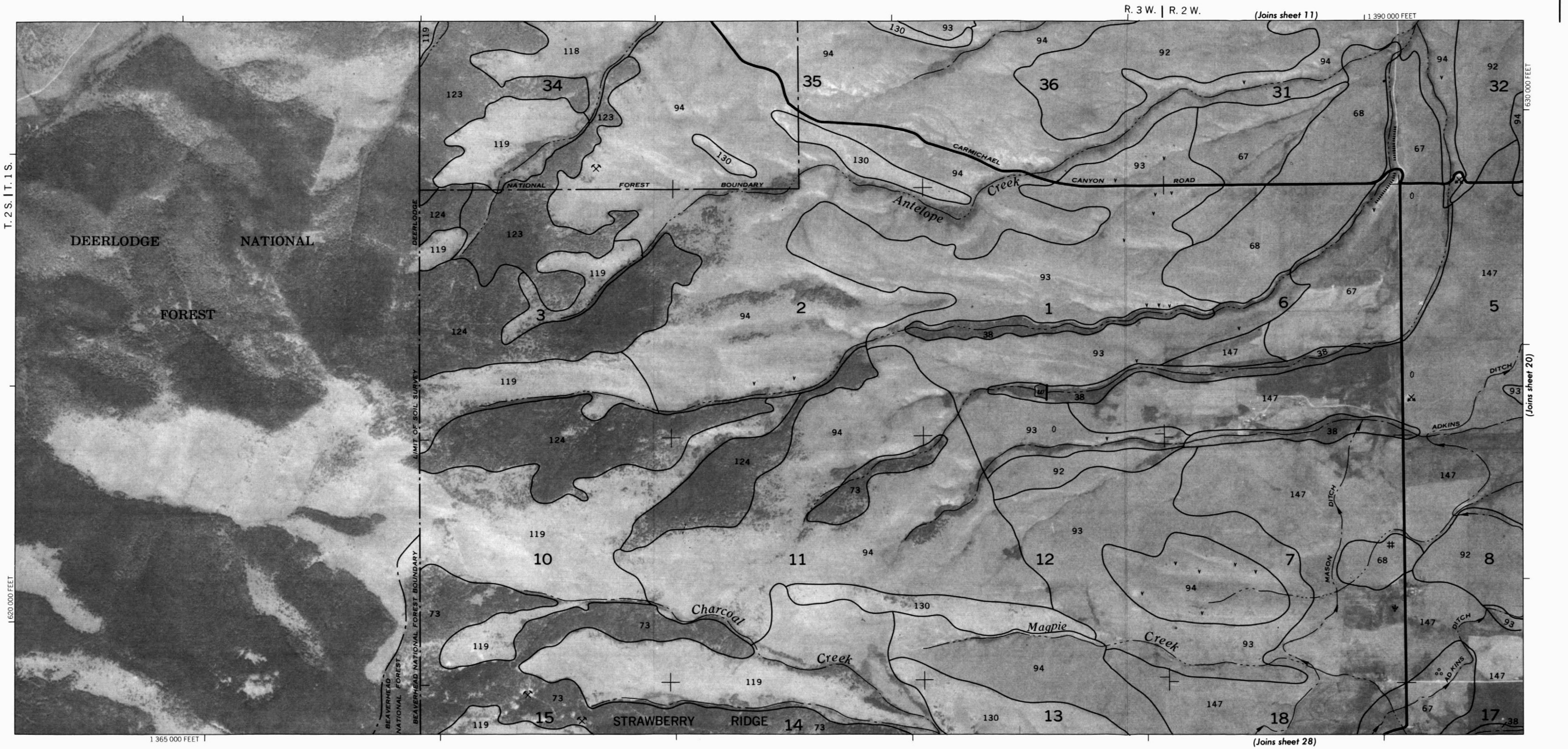


3000 AND 5000-FOOT GRID TICKS

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

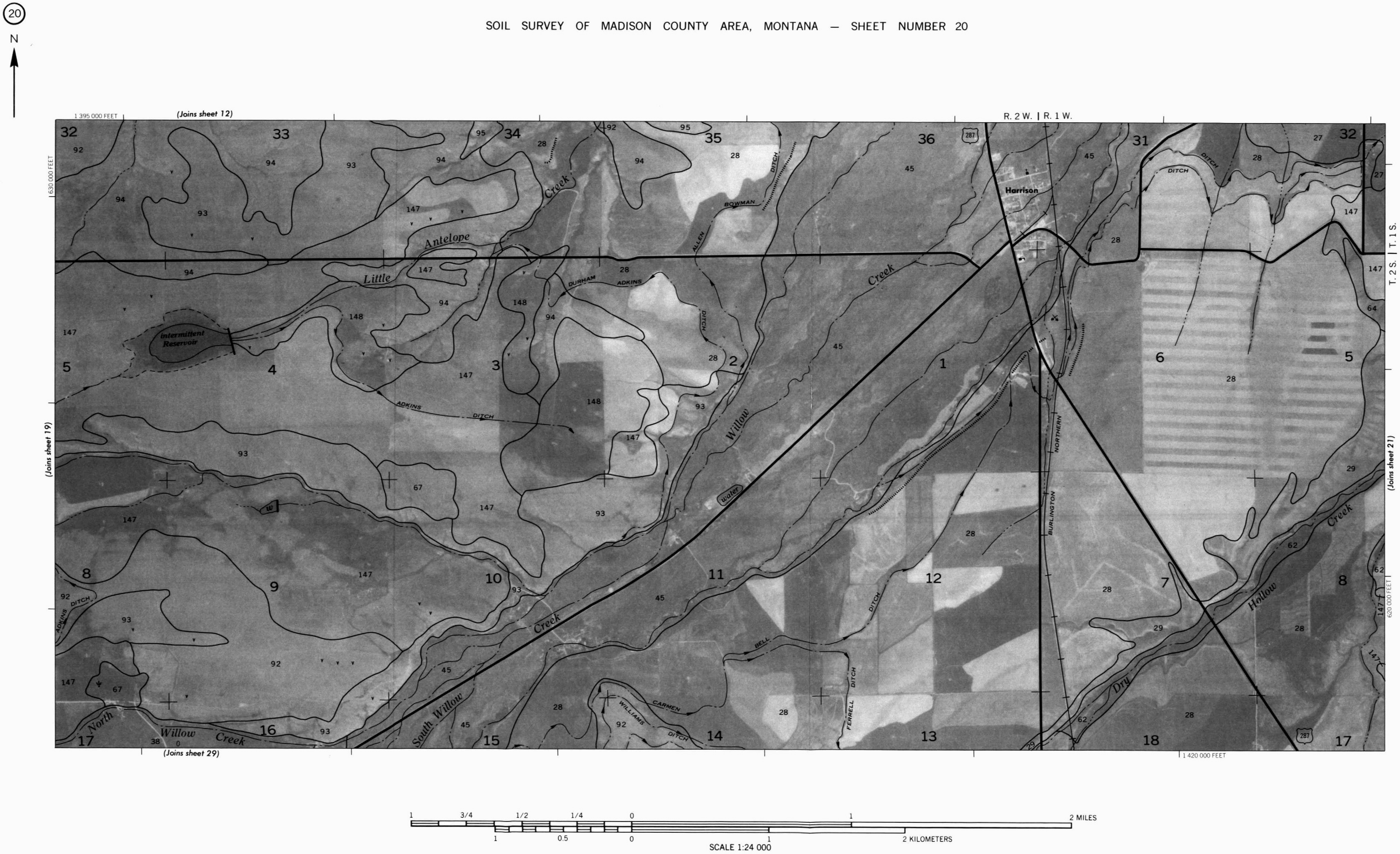


1 3/4 1/2 1/4 0 1 2 MILES

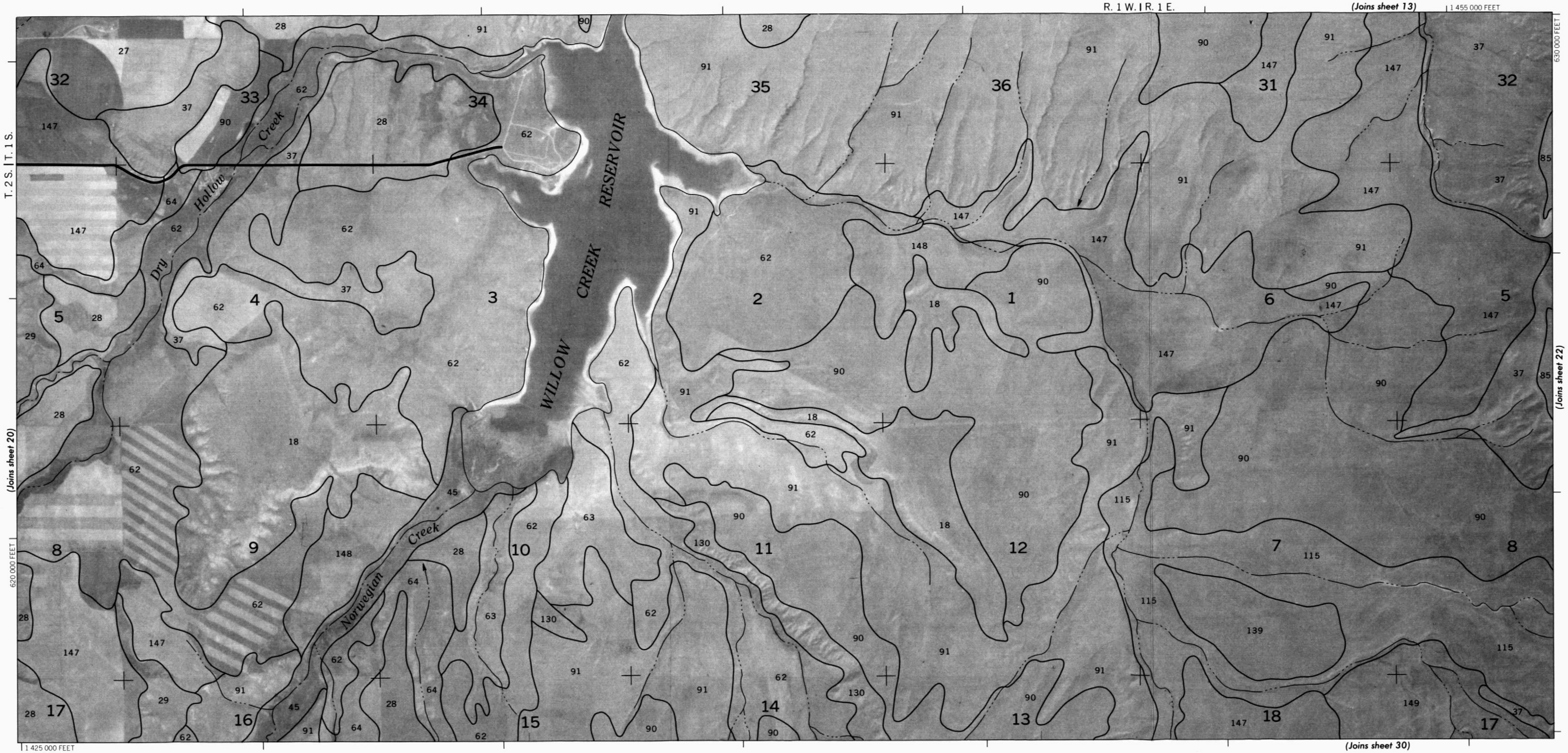
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 20



N

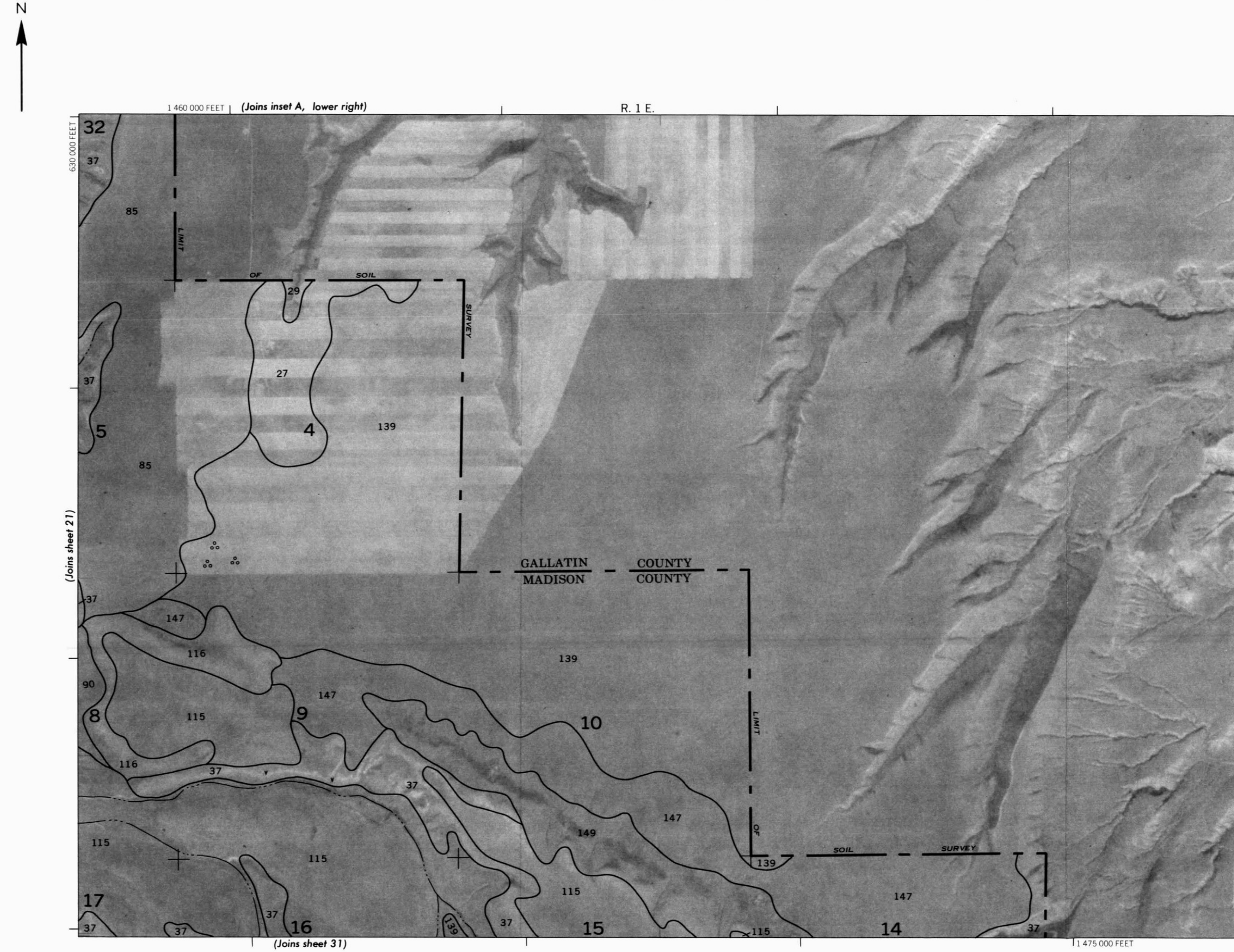


1 3/4 1/2 1/4 0 1 2 MILES

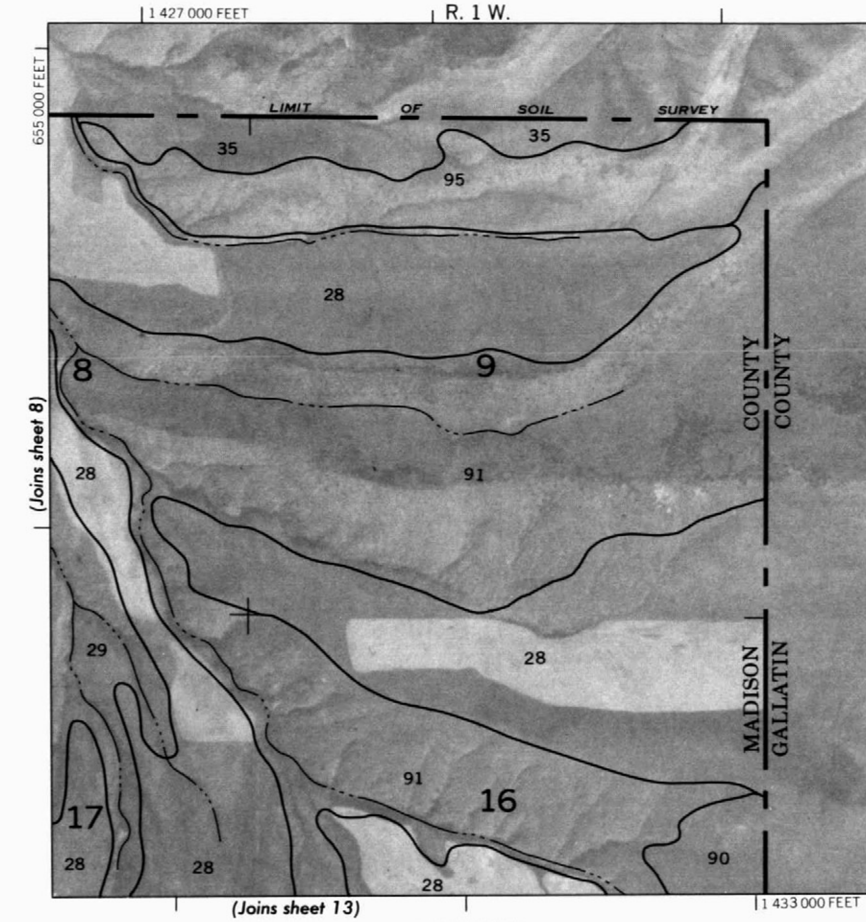
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 22

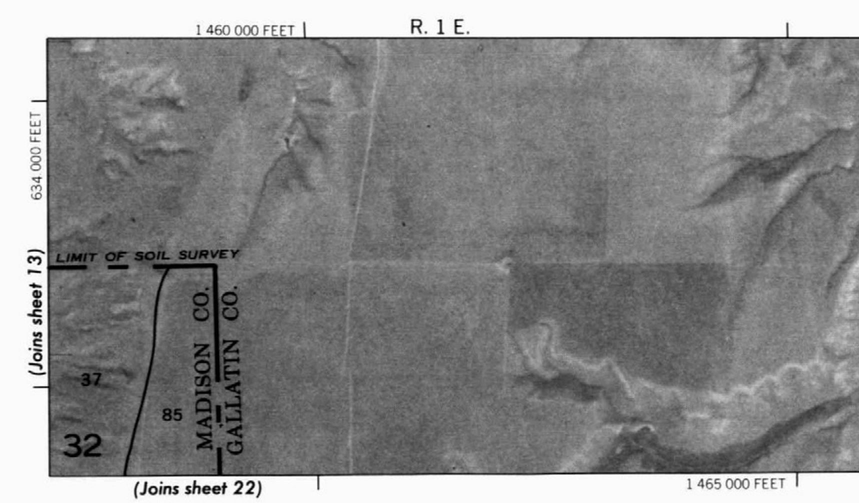


INSET B



3000 AND 5000-FOOT GRID TICKS

INSET A



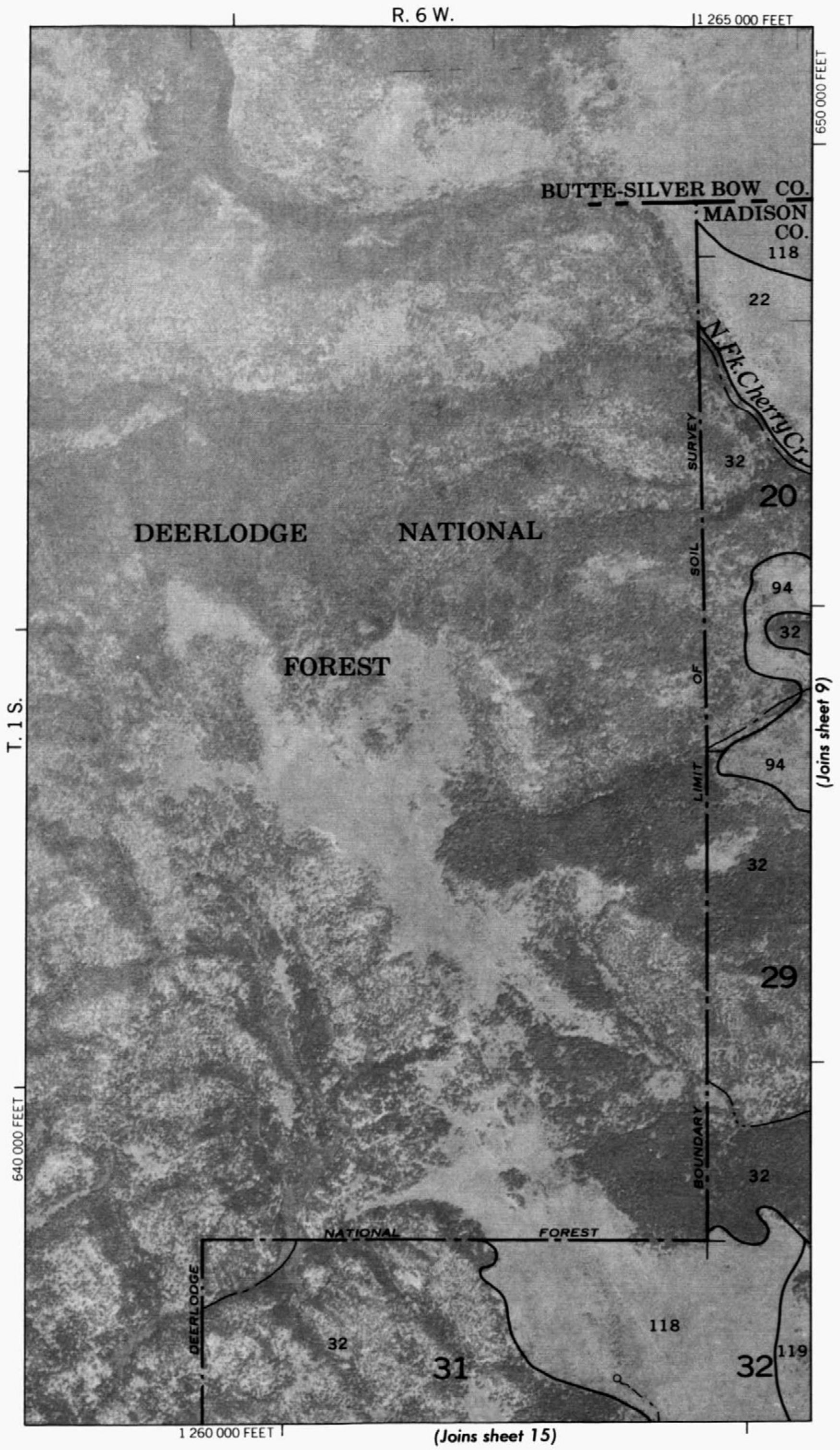
3000 AND 5000-FOOT GRID TICKS

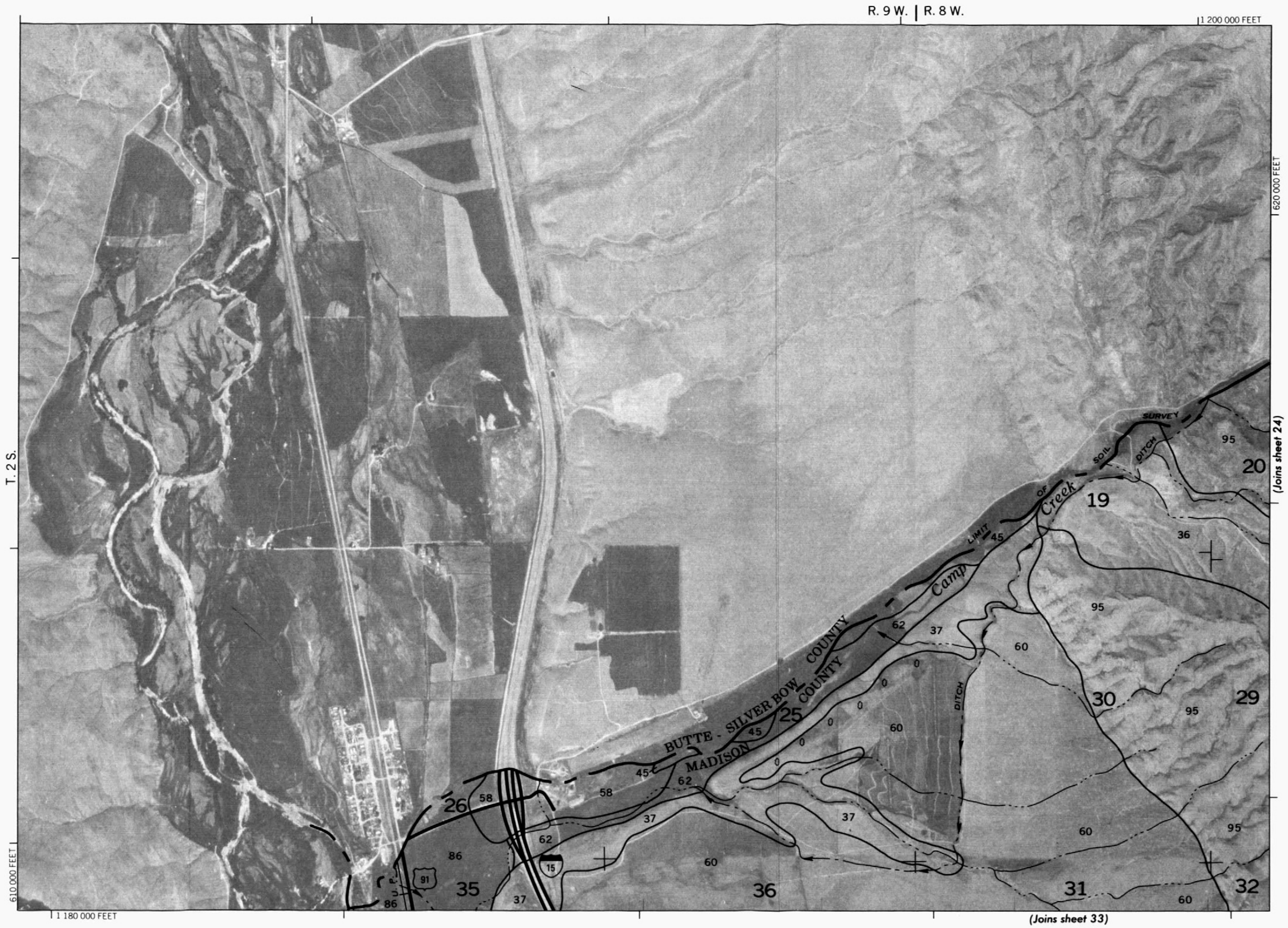
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N





1 3/4 1/2 1/4 0 1 2 MILES

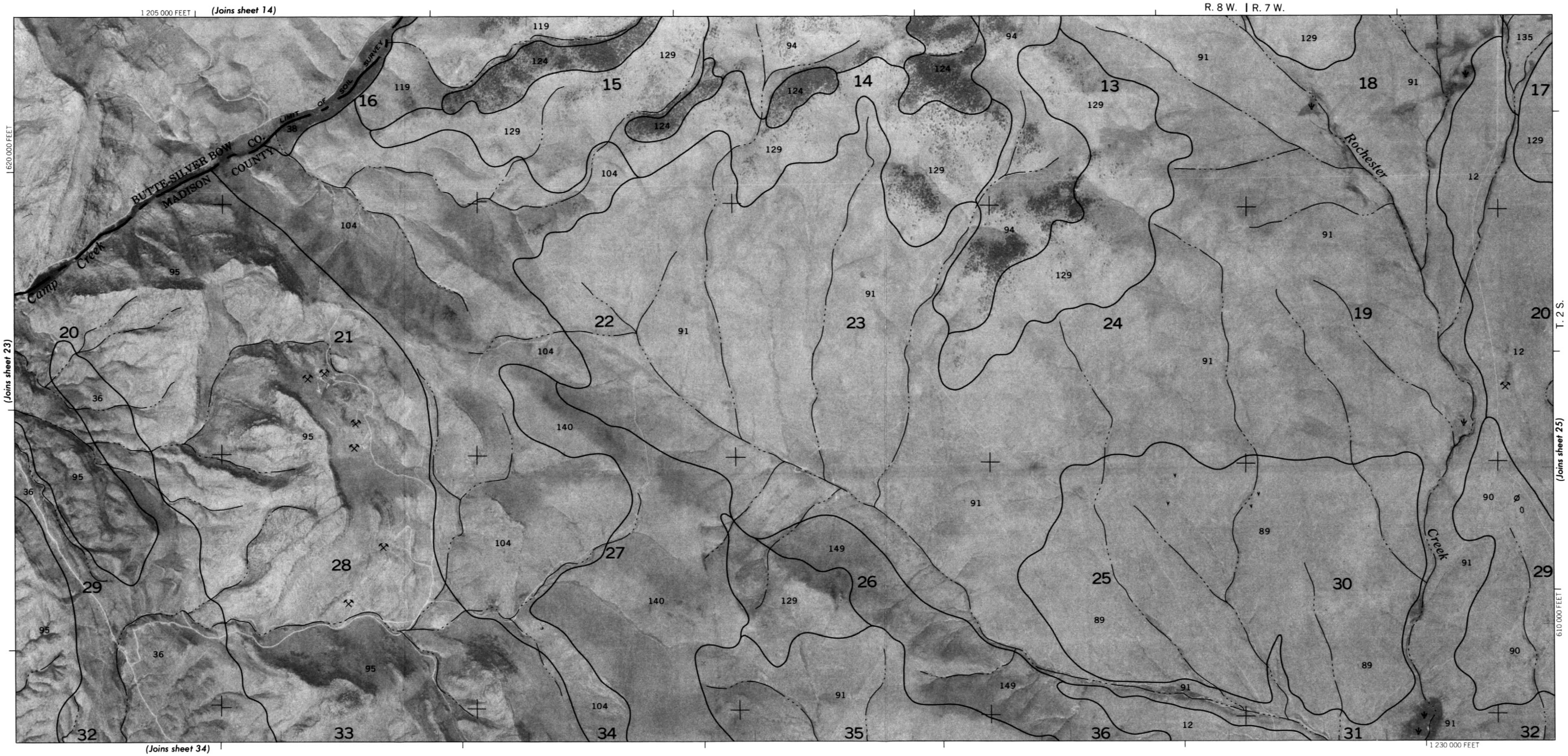
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

24

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 24

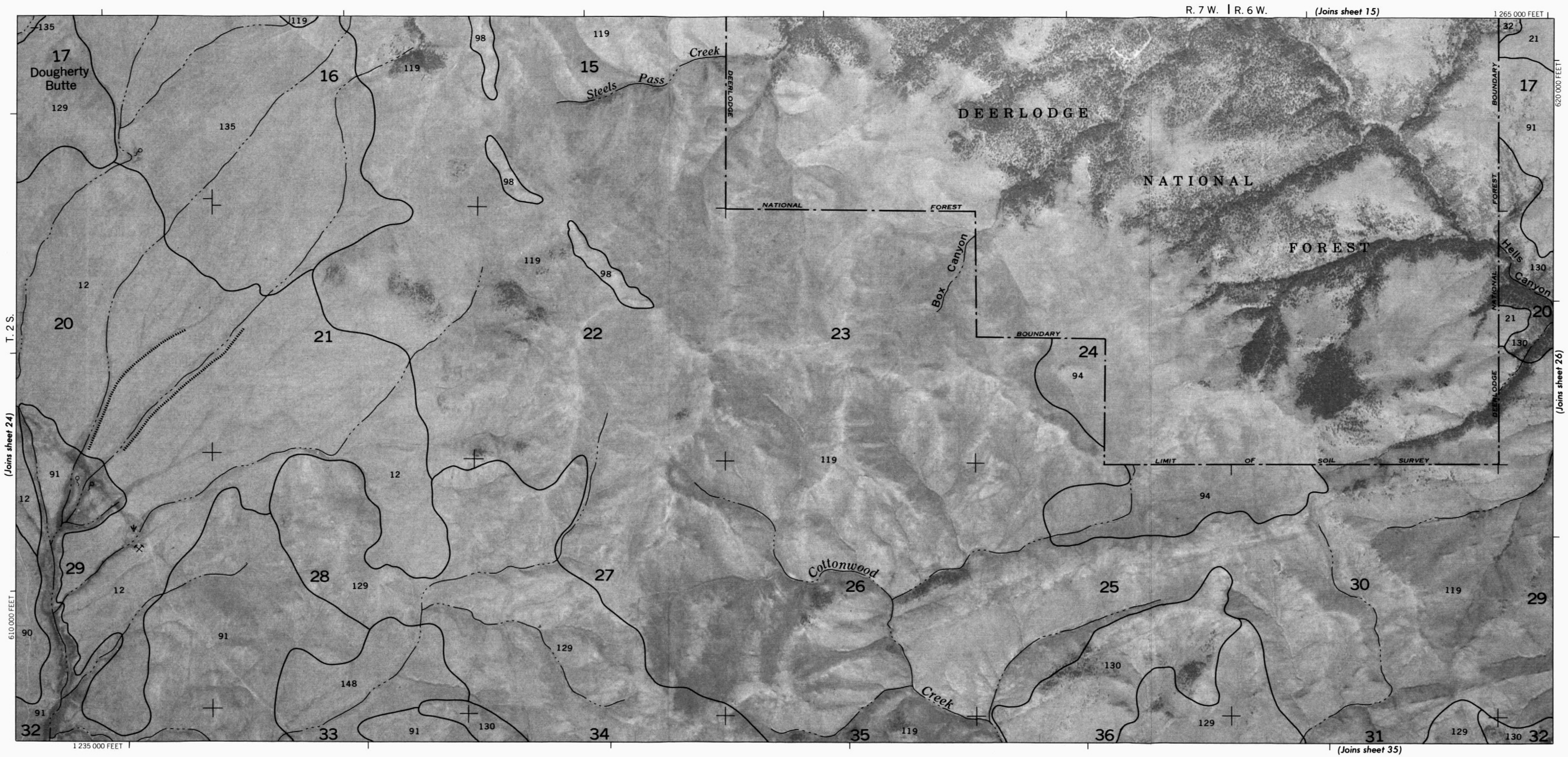


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

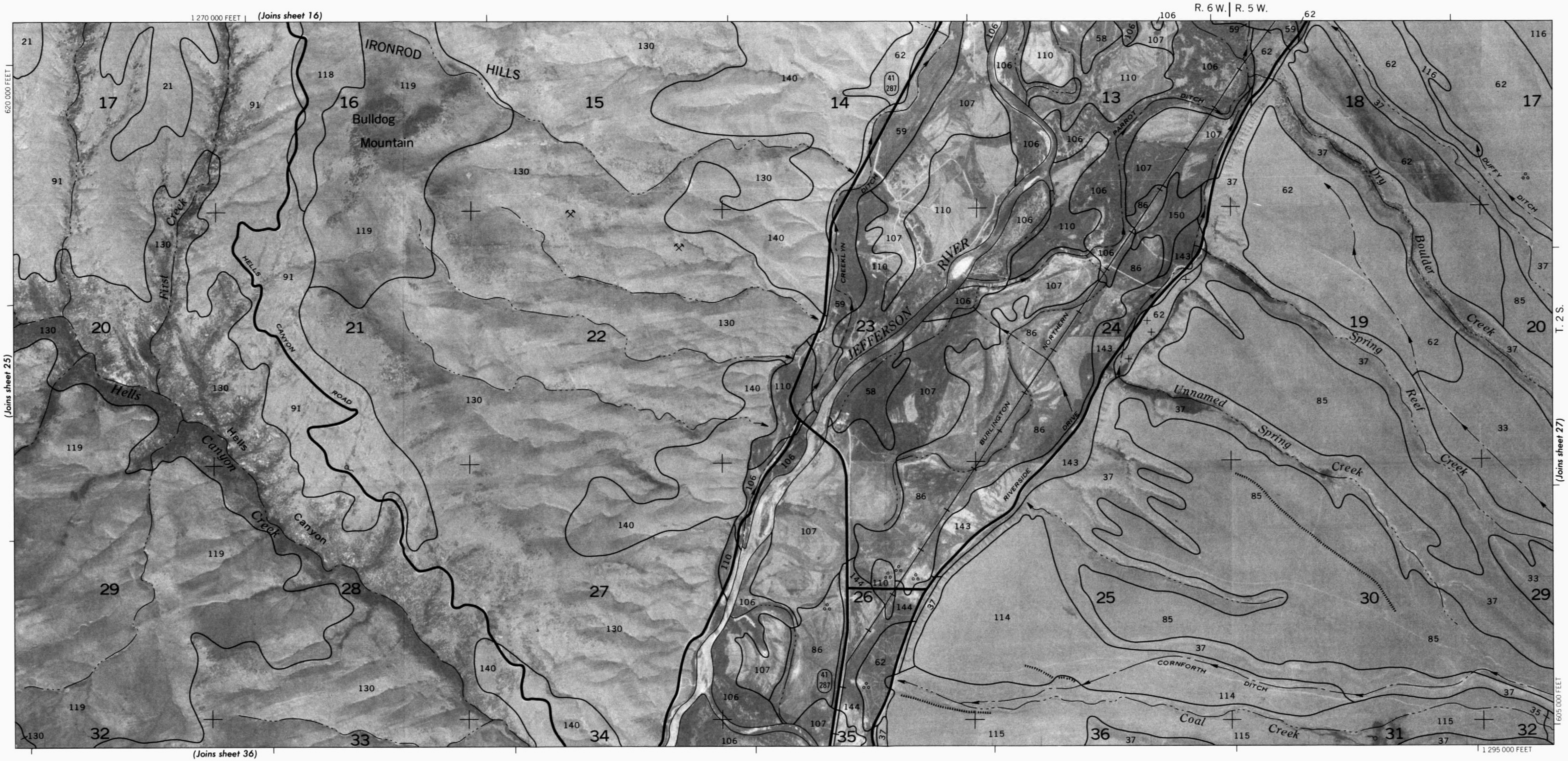


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 26

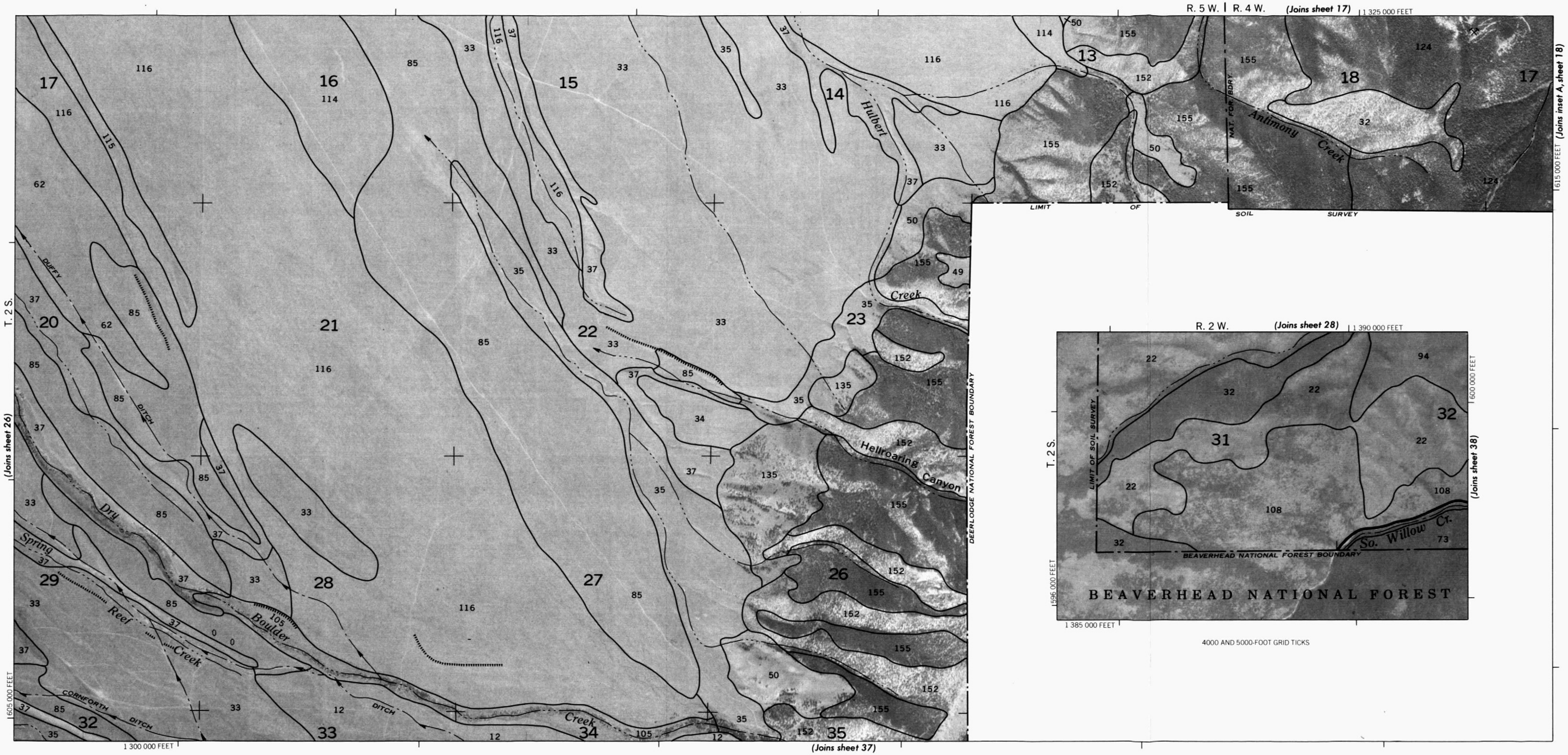


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N



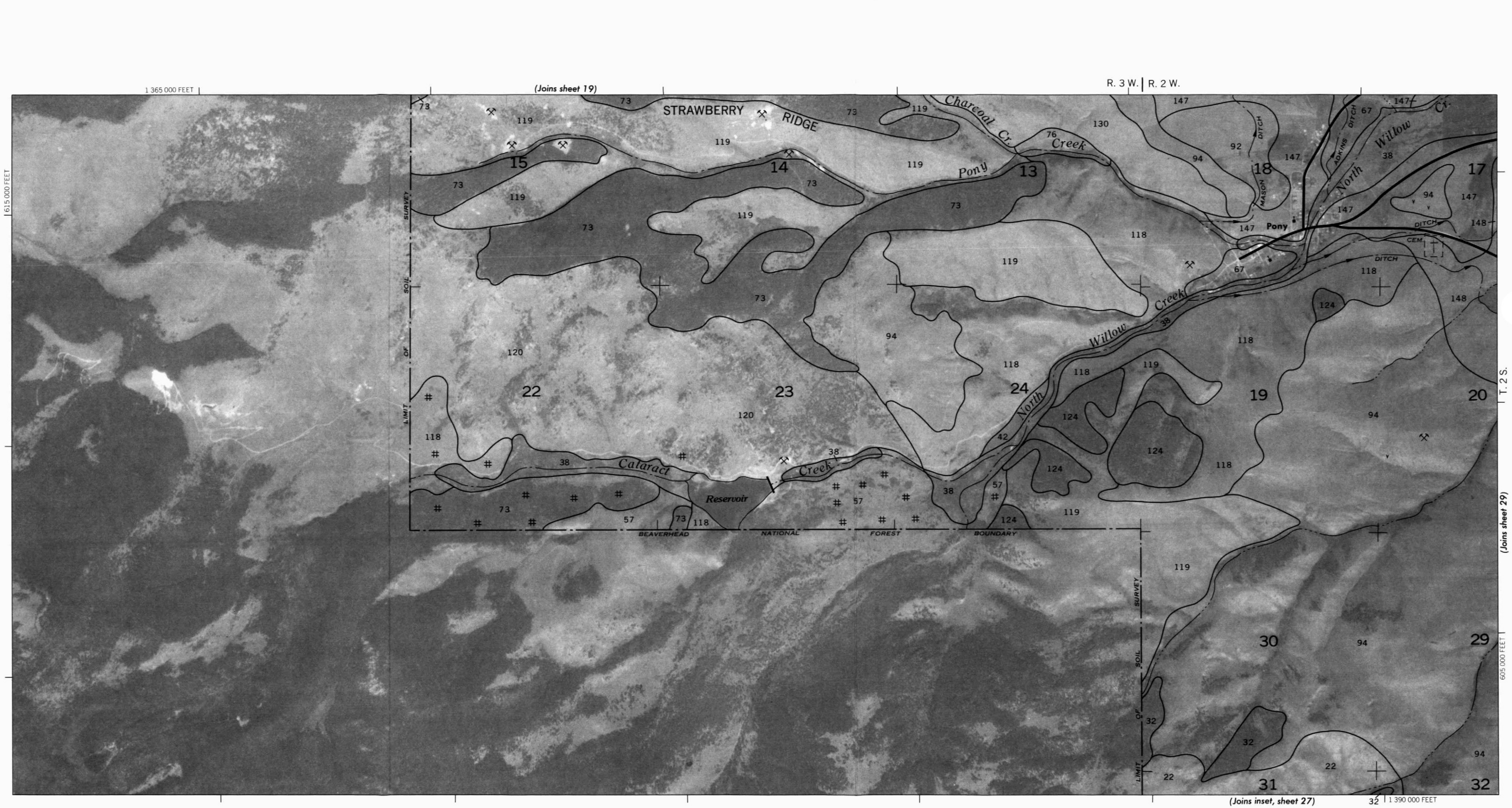
4000 AND 5000-FOOT GRID TICKS

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 28



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

1 3/4 1/2 1/4 0 1 2 MILES

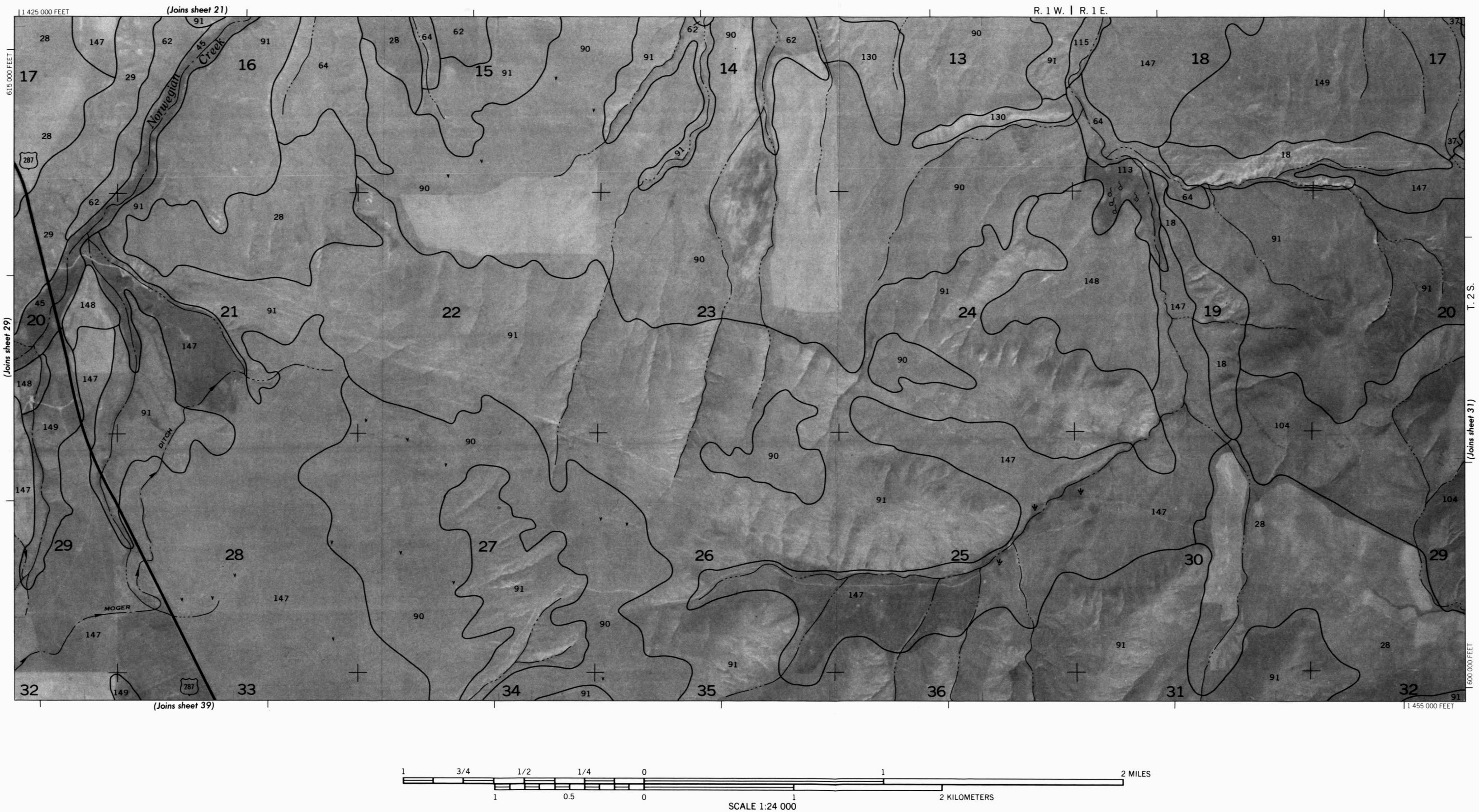
1 0.5 0 1 2 KILOMETERS

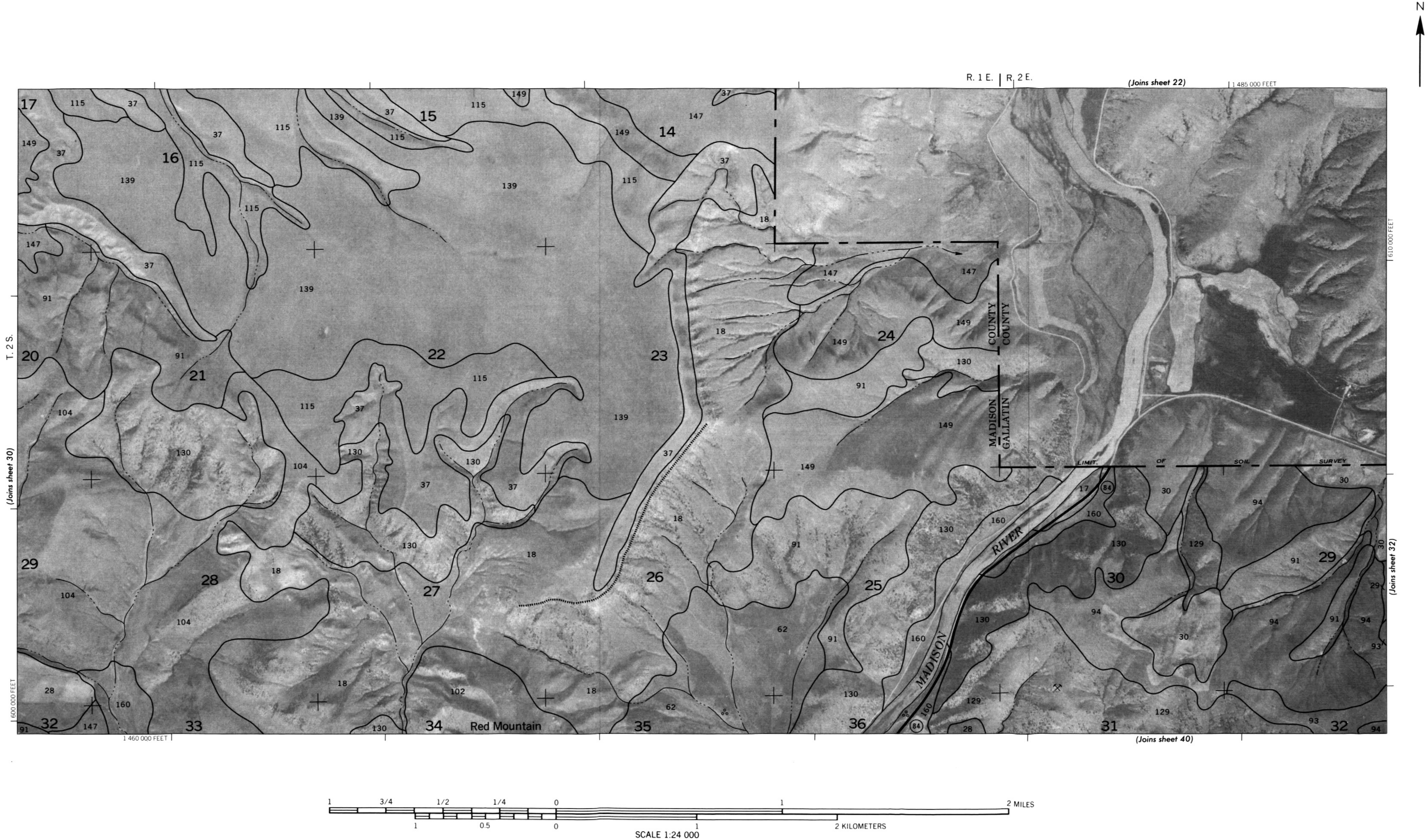
SCALE 1:24 000

30

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 30

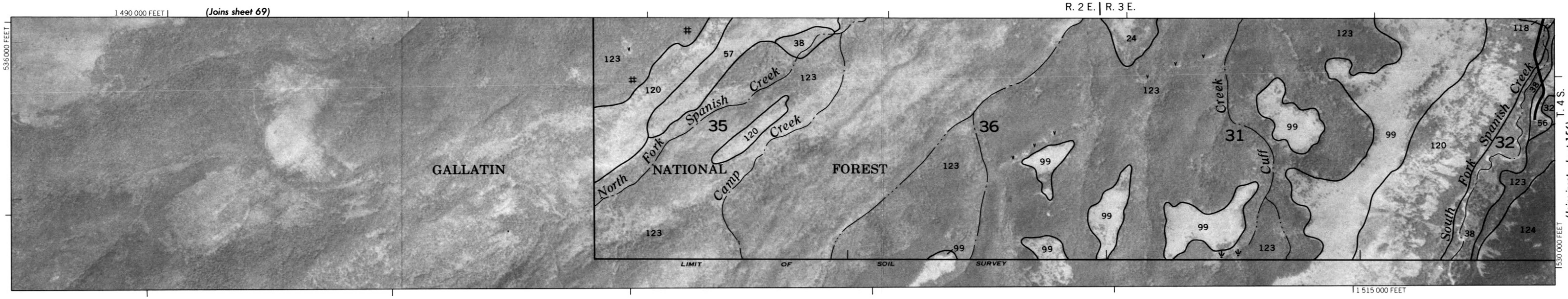



N
R. 1 E. | R. 2 E.
(Joins sheet 22)
1 485 000 FEET
610 000 FEET
T. 2 S.
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 40)
600 000 FEET
1 460 000 FEET
MADISON COUNTY
GALLATIN COUNTY
LIMIT OF SOIL SURVEY
MADISON RIVER
Red Mountain
84
160
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

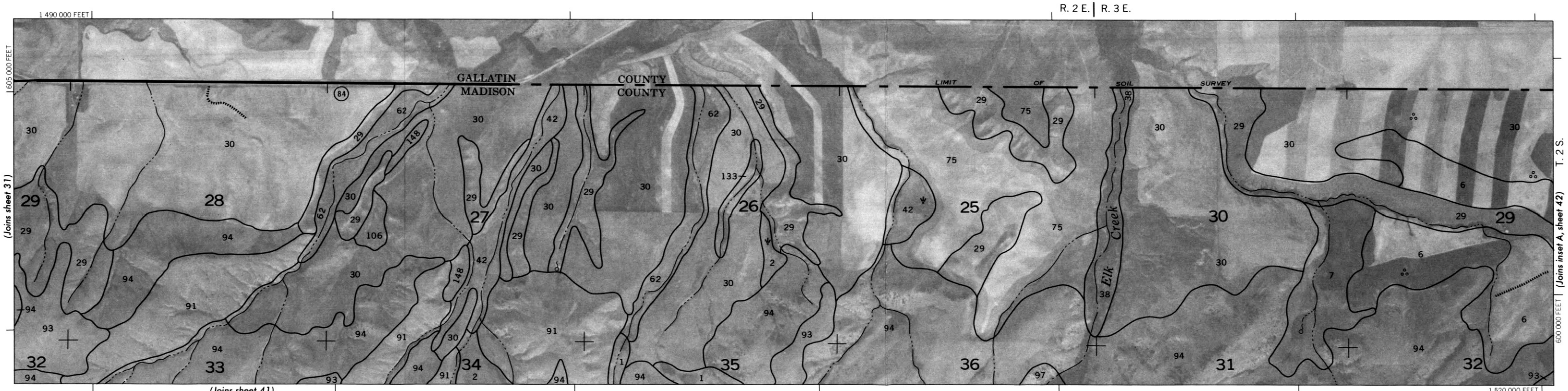
N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 32

INSET



4000 AND 5000-FOOT GRID TICKS



1 3/4 1/2 1/4 0 1 2 MILES

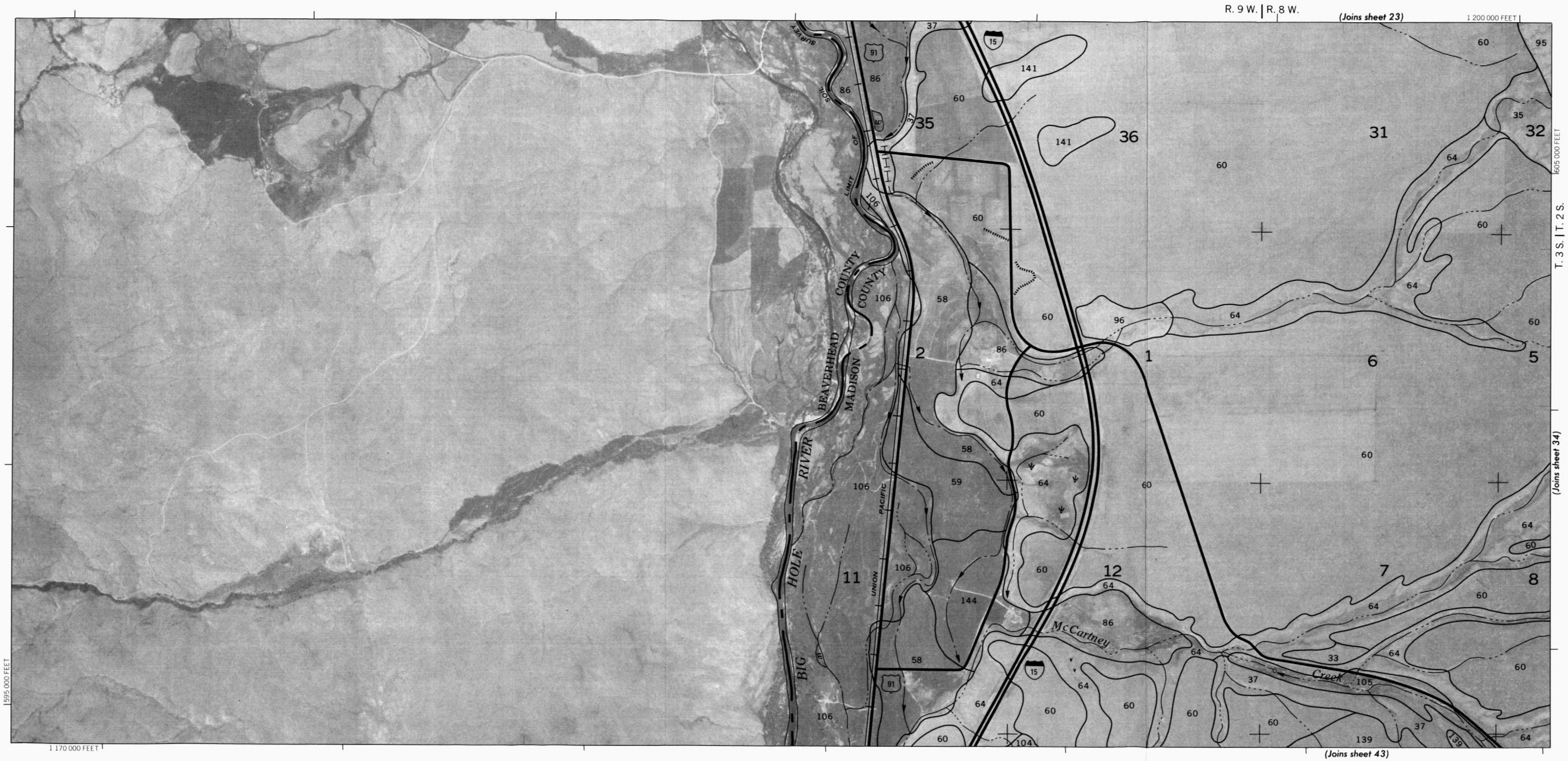
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 33

33

N



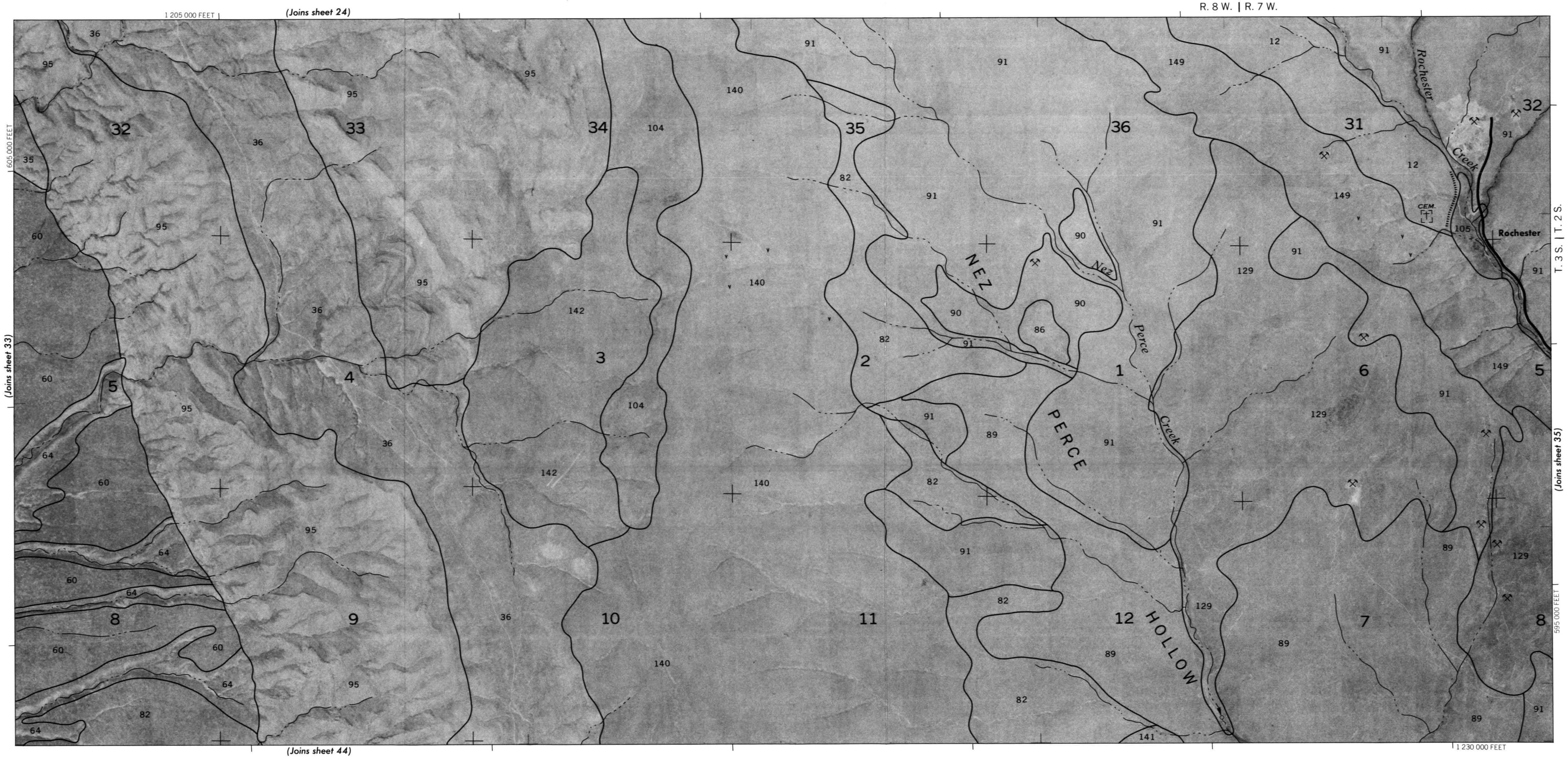
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 34

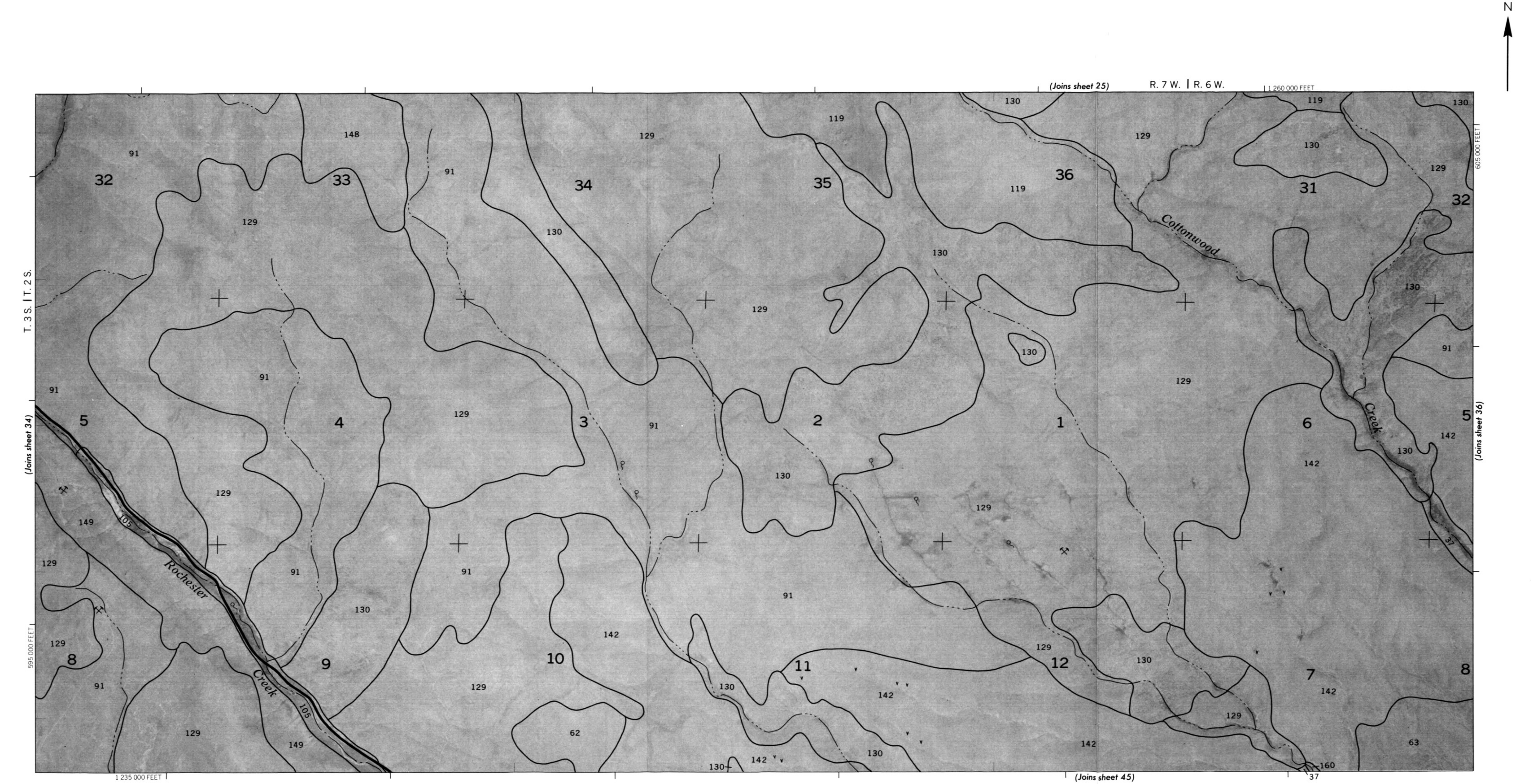


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1975, 1976, and 1977 aerial photography.
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

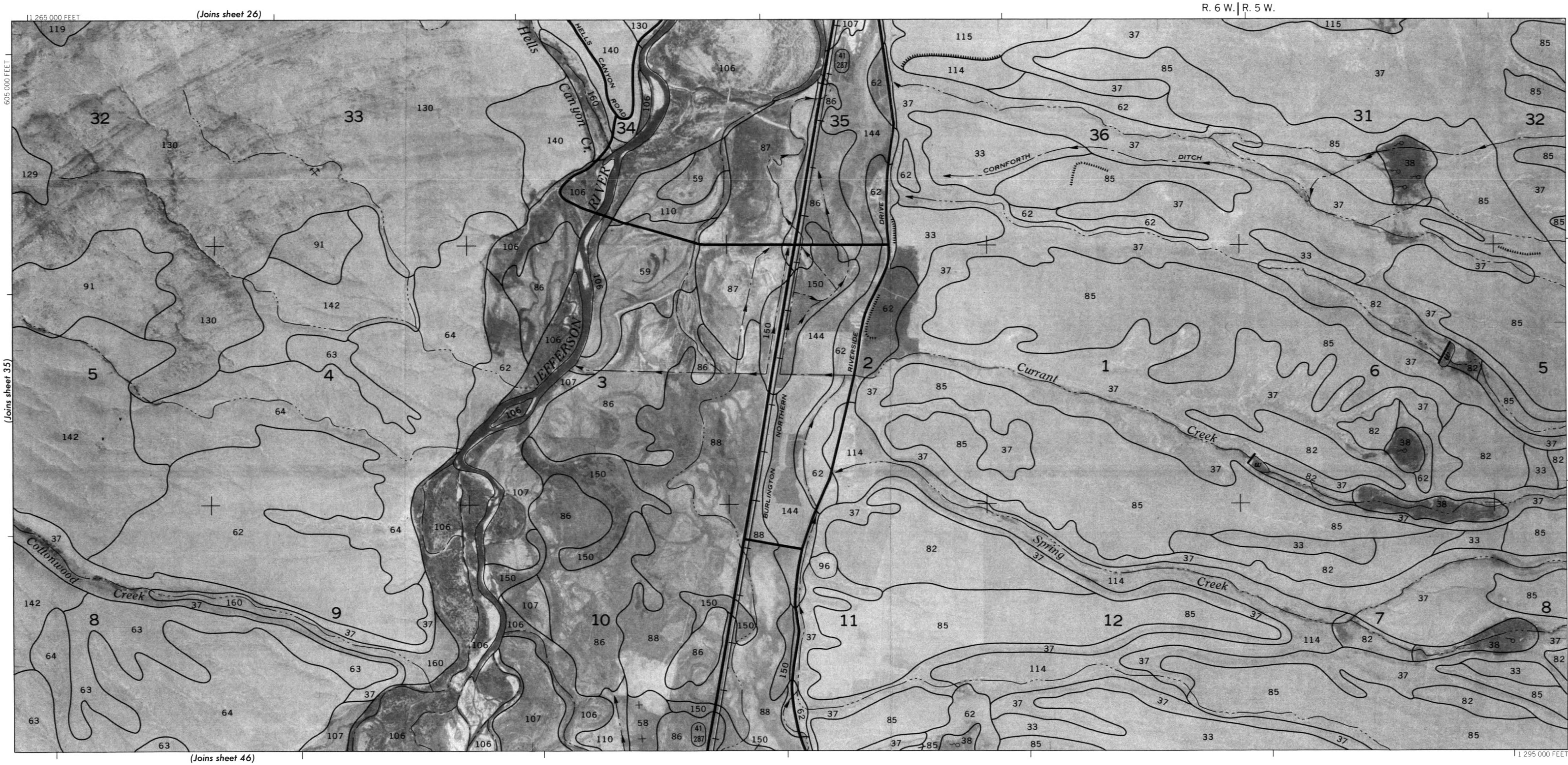


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

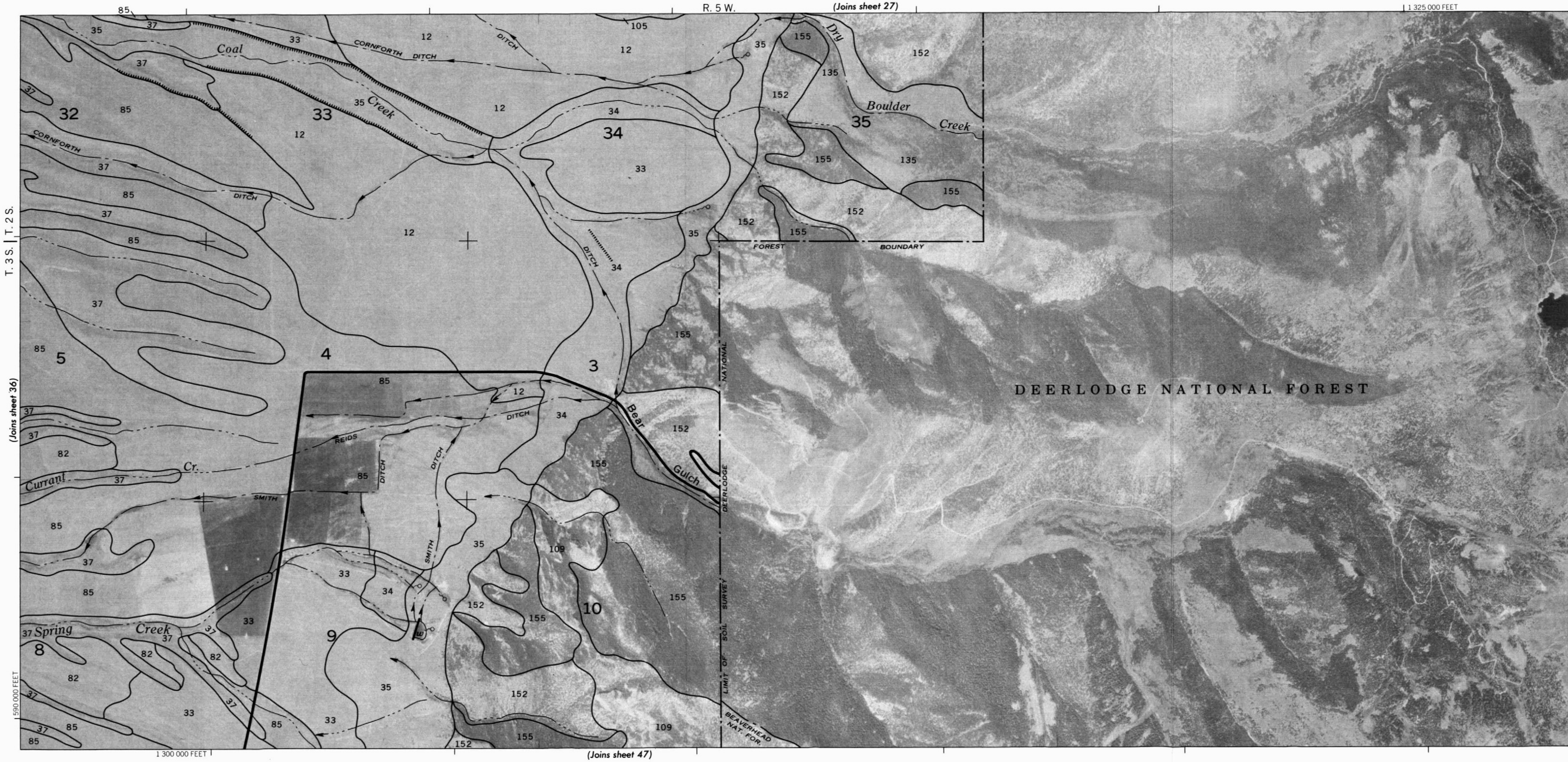
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 36



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

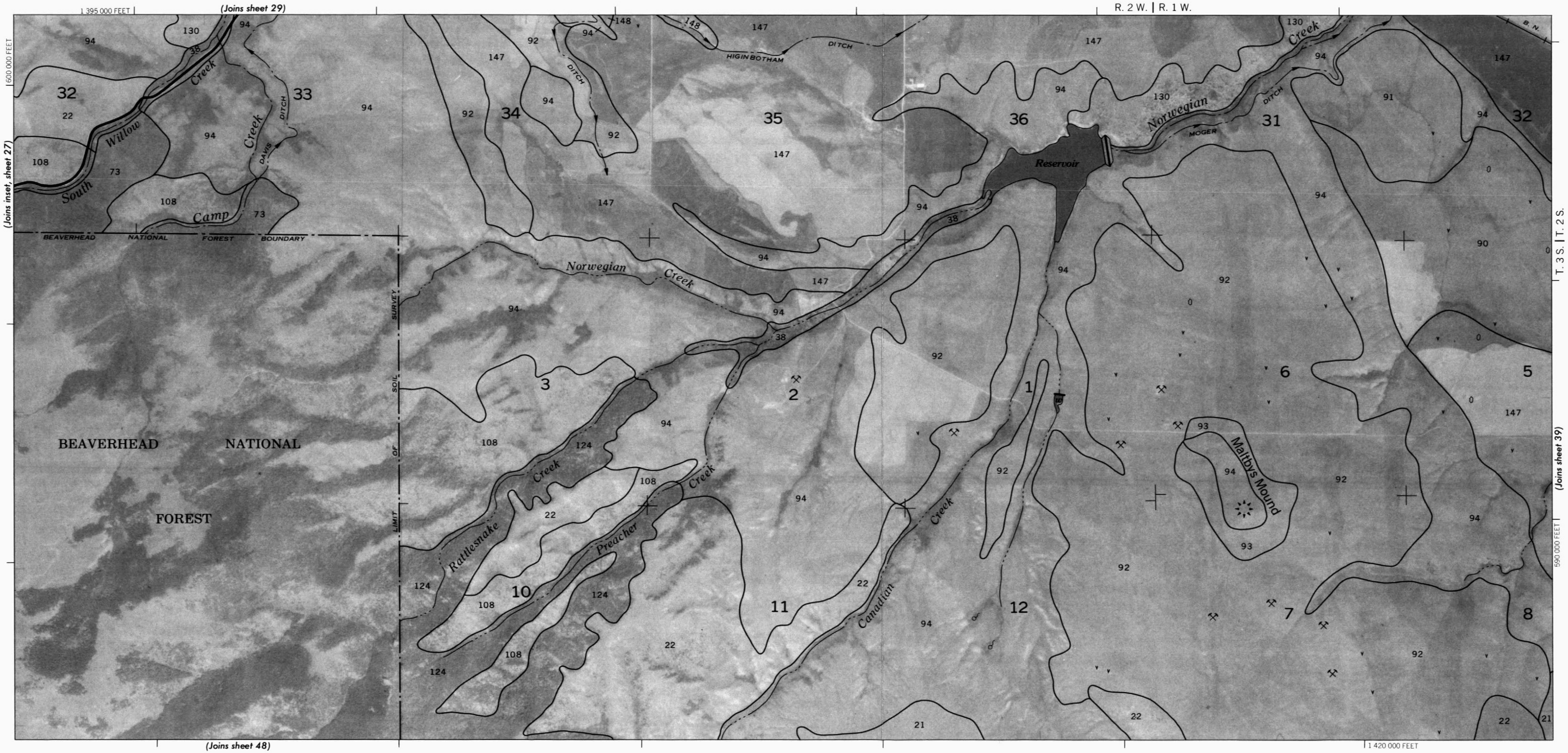
SCALE 1:24 000


N
R. 5 W.
(Joins sheet 27)
1 325 000 FEET
600 000 FEET
T. 3 S. | T. 2 S.
(Joins sheet 36)
590 000 FEET
1 300 000 FEET
(Joins sheet 47)
Coal Creek
Cornforth Ditch
Ditch
Dry Boulder Creek
Forest Boundary
Bear Gulch
Reids Ditch
Smith Ditch
Currant Cr.
Spring Creek
Deerlodge National Forest
Limit of Soil Survey
Beaverhead Nat. For.
DEERLODGE NATIONAL FOREST
32
33
34
35
5
4
3
8
9
10

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 38



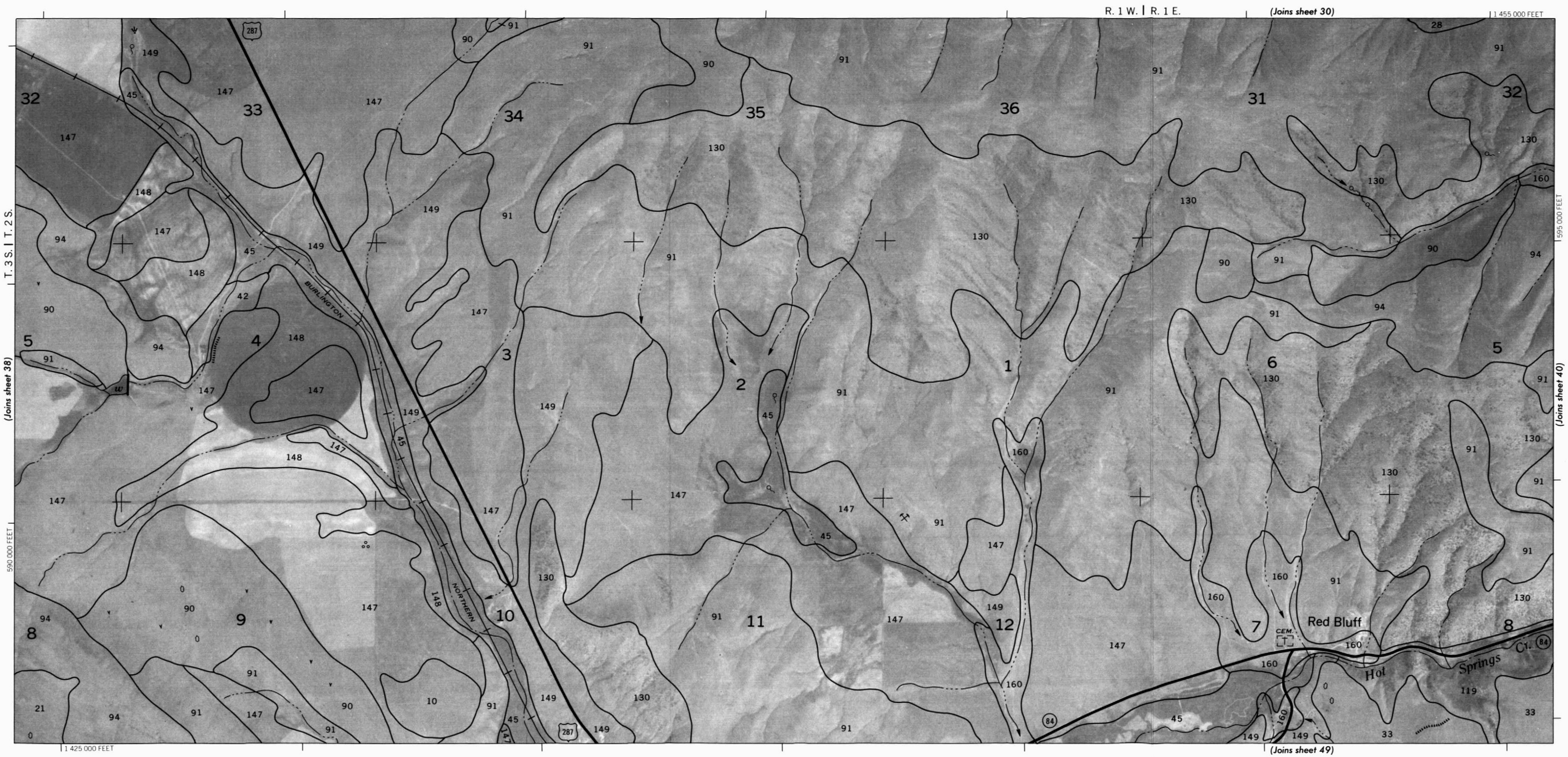
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

39

N

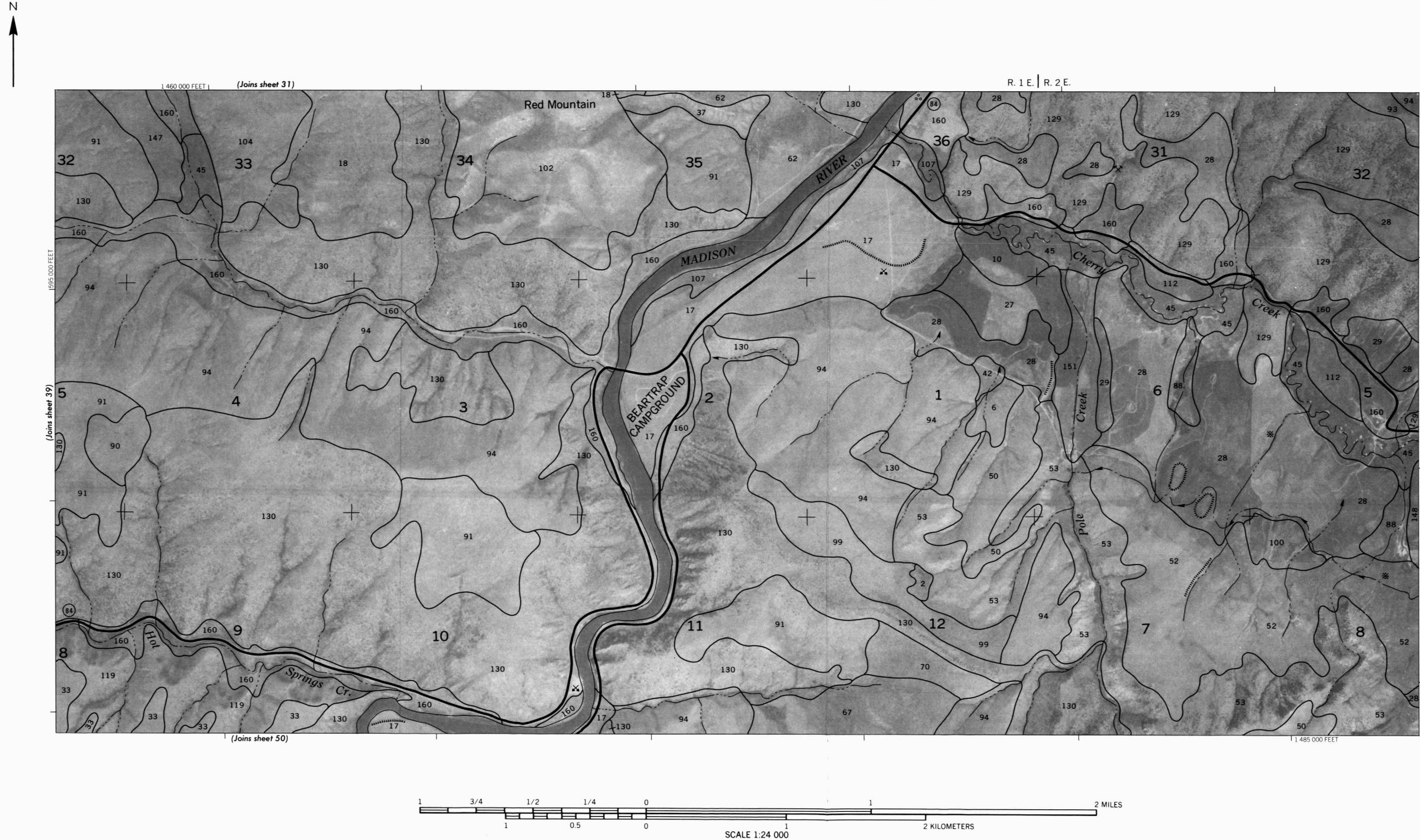


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

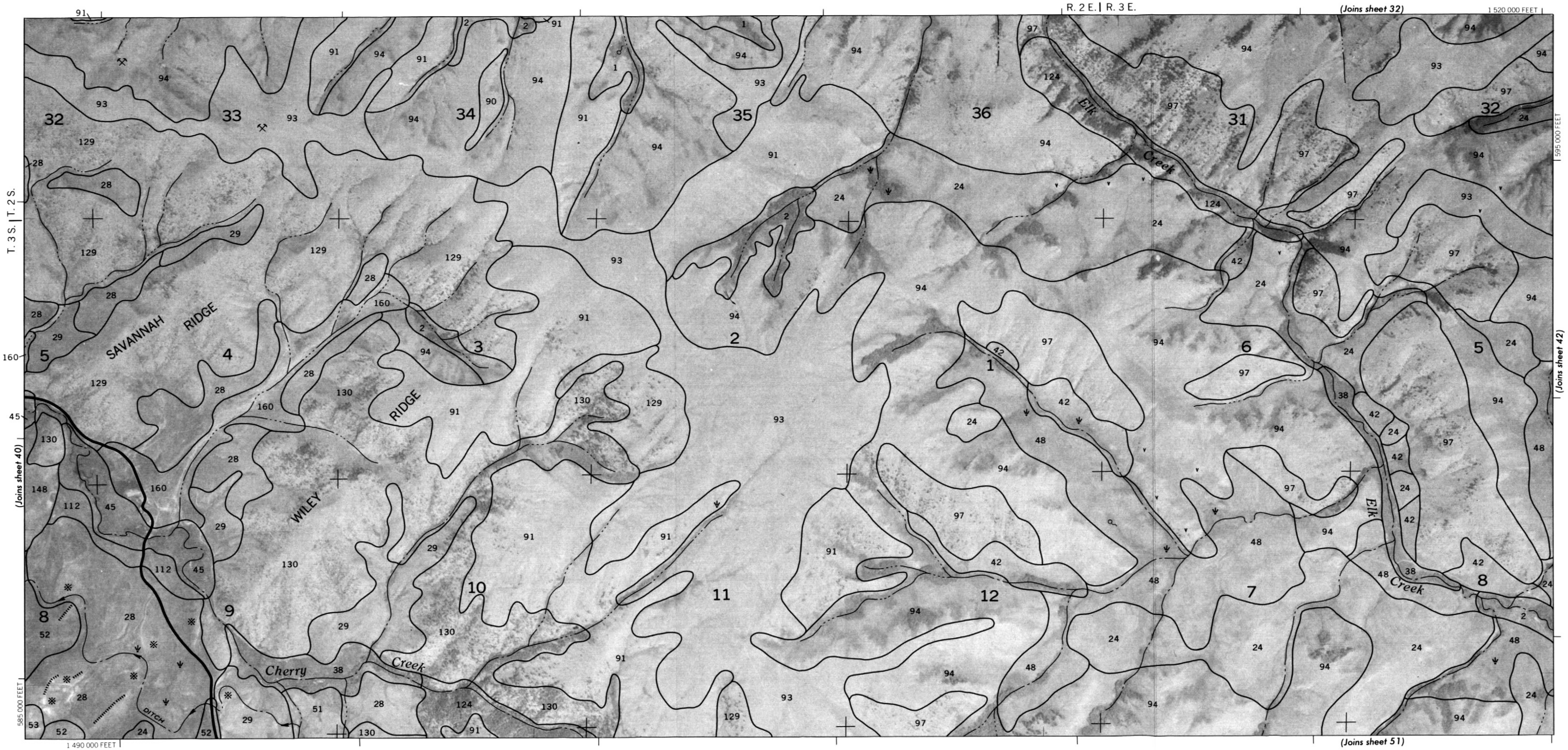
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 40



41

N



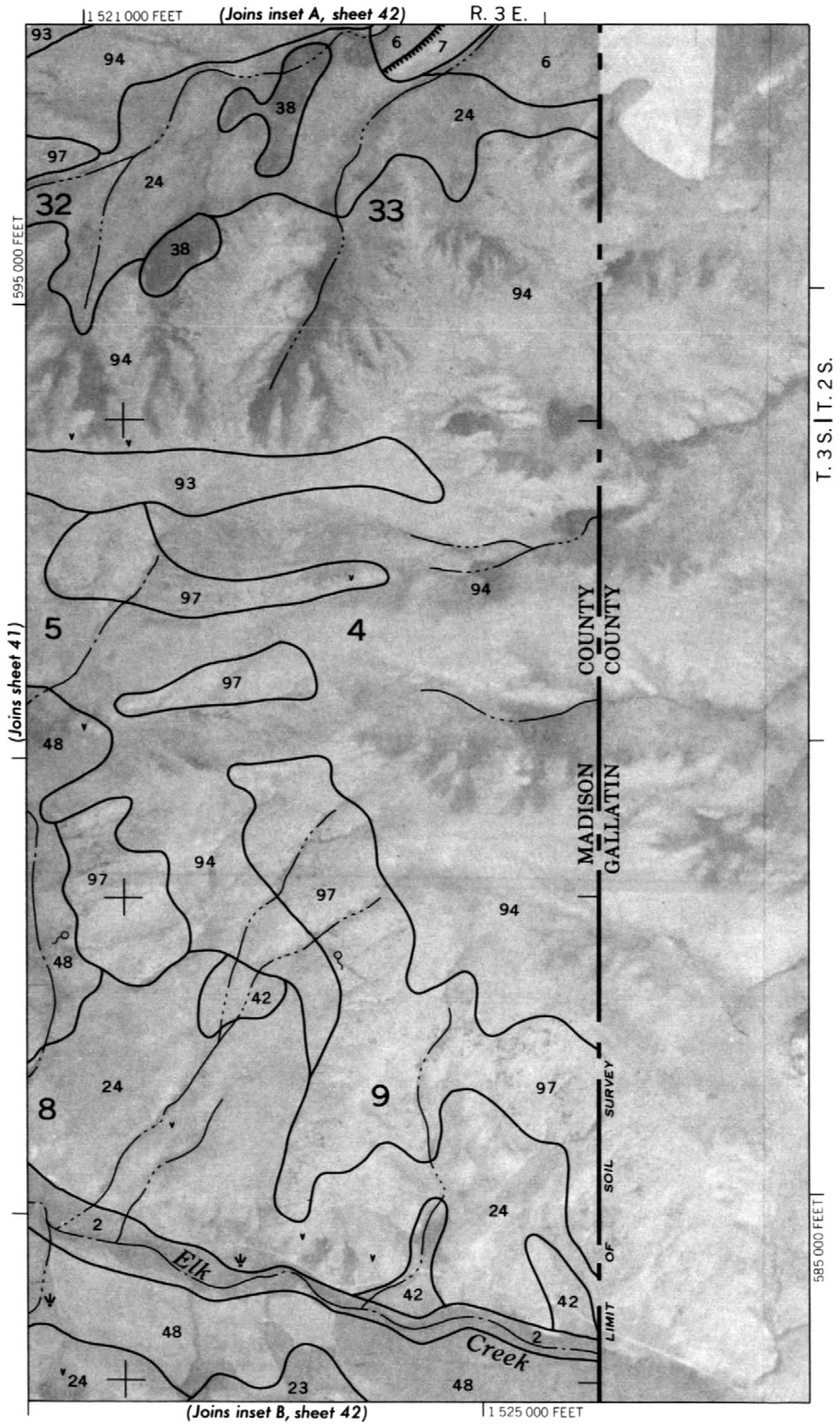
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

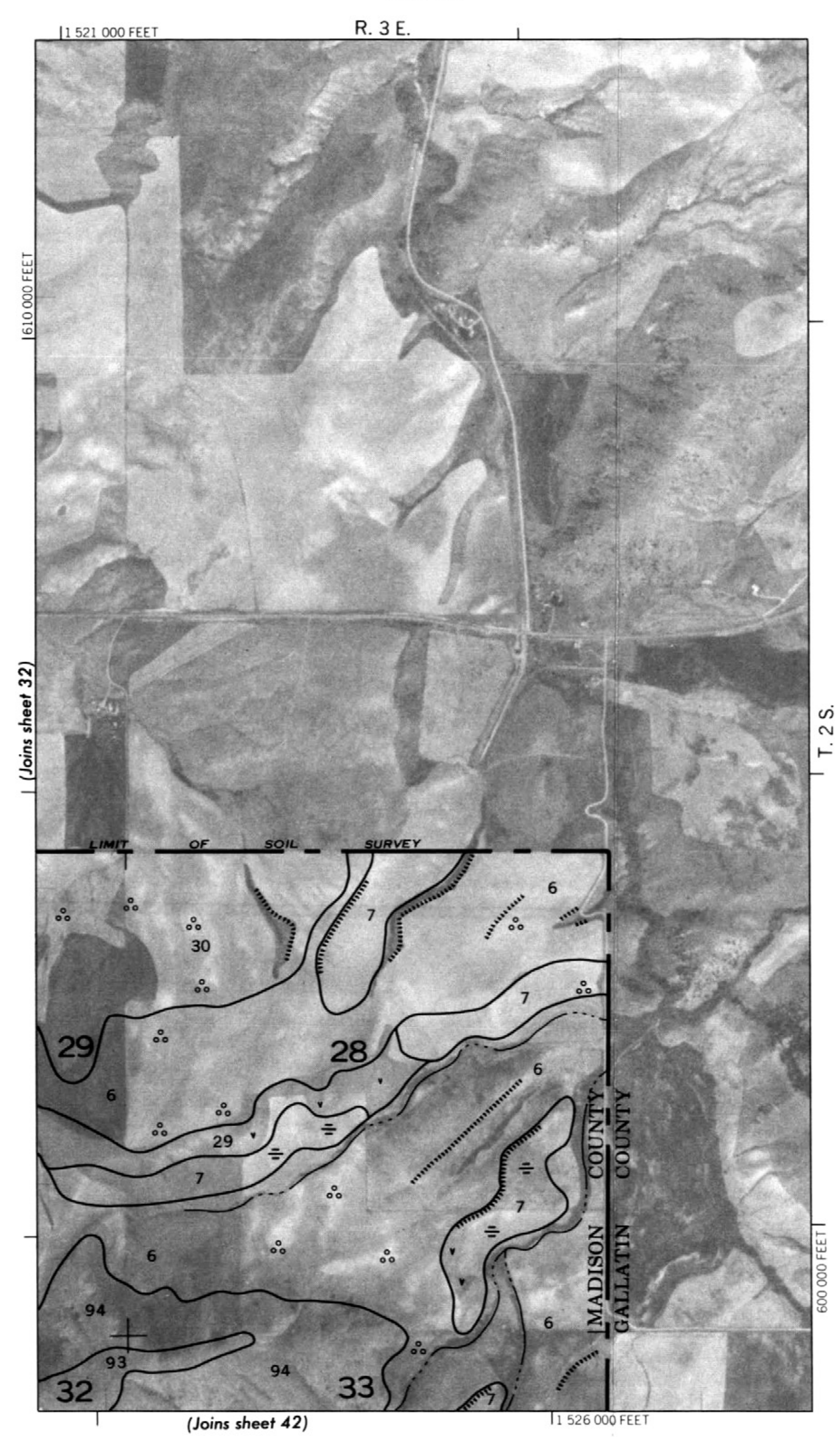
SCALE 1:24 000

42

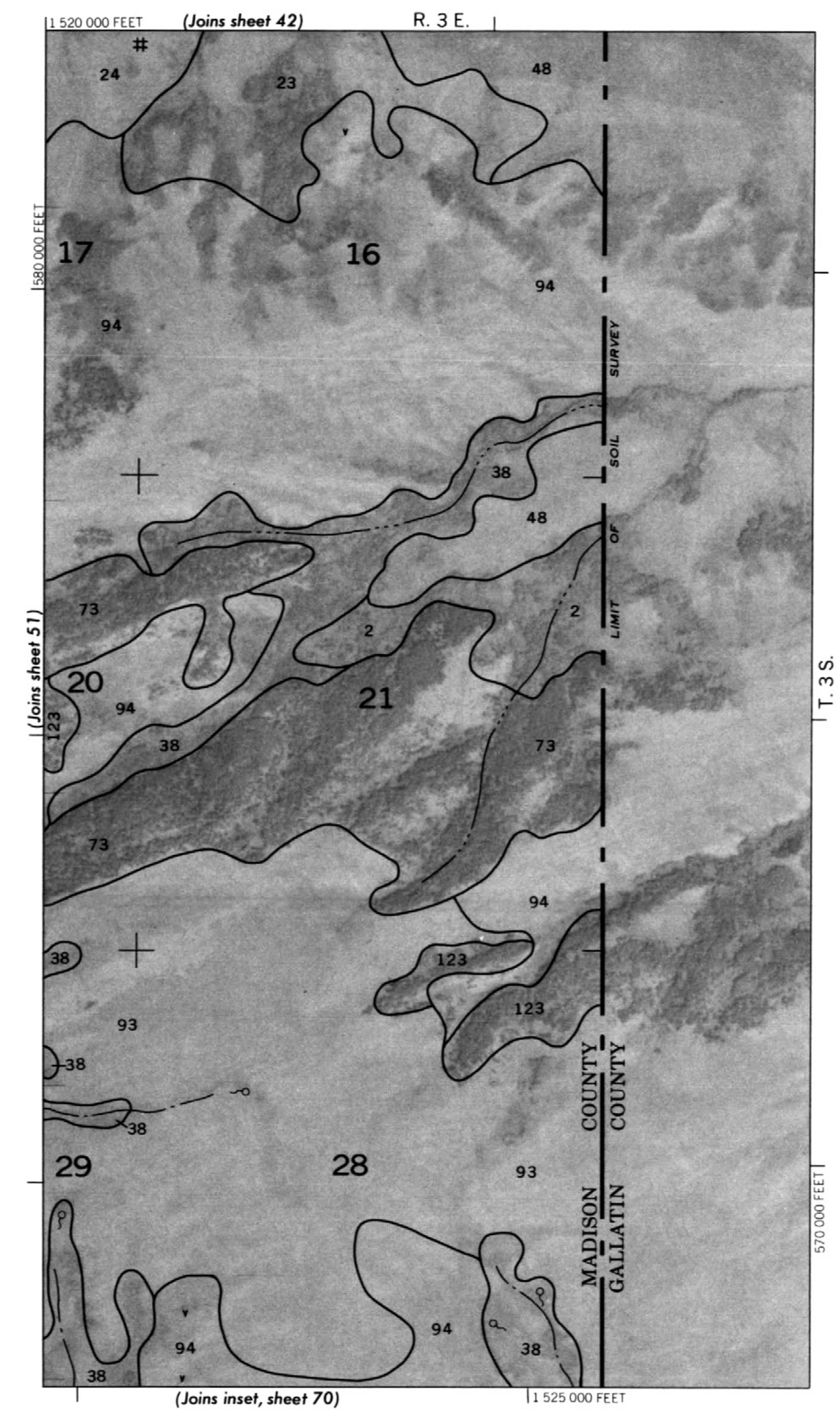
N



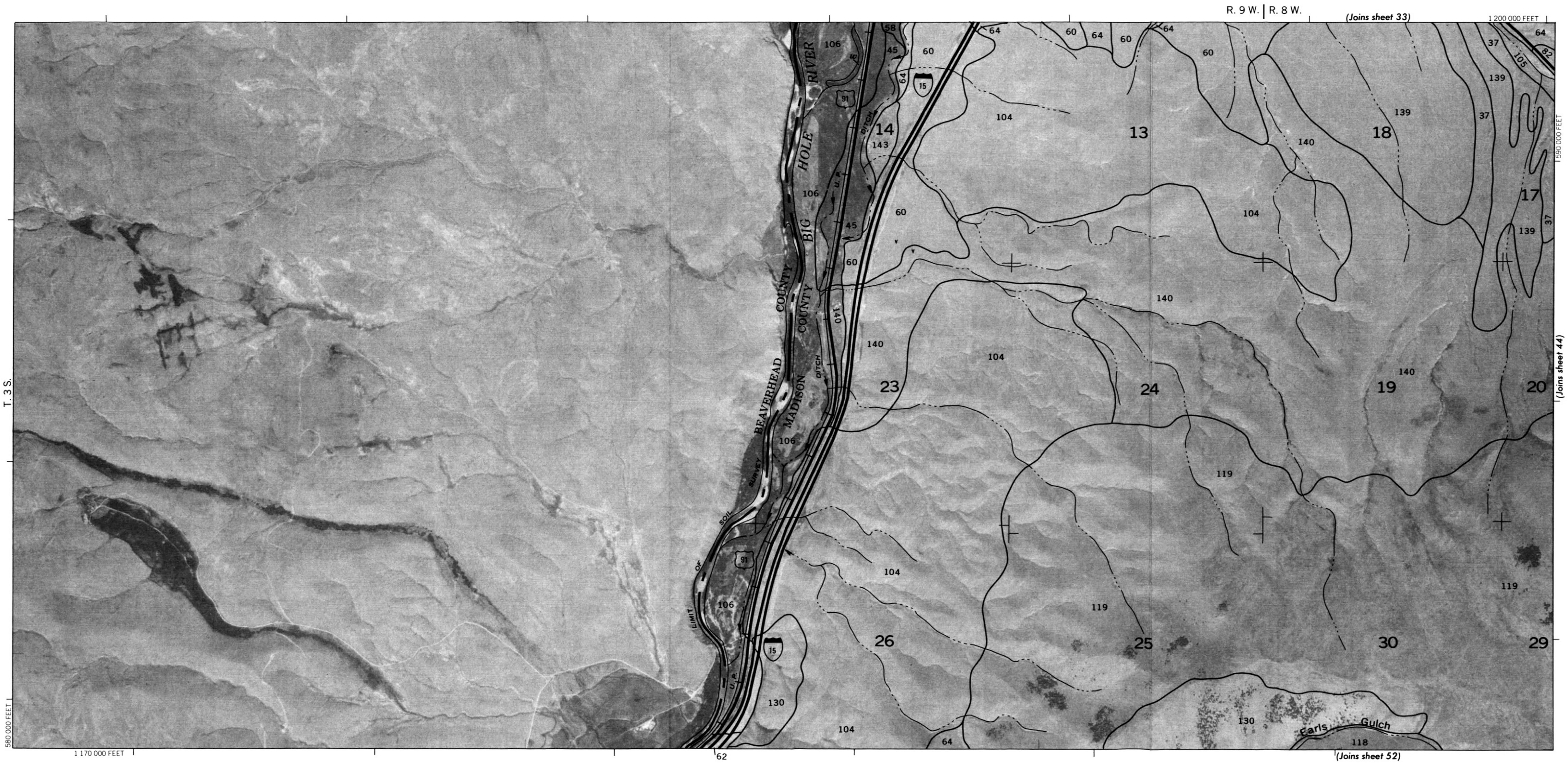
INSET A



INSET B

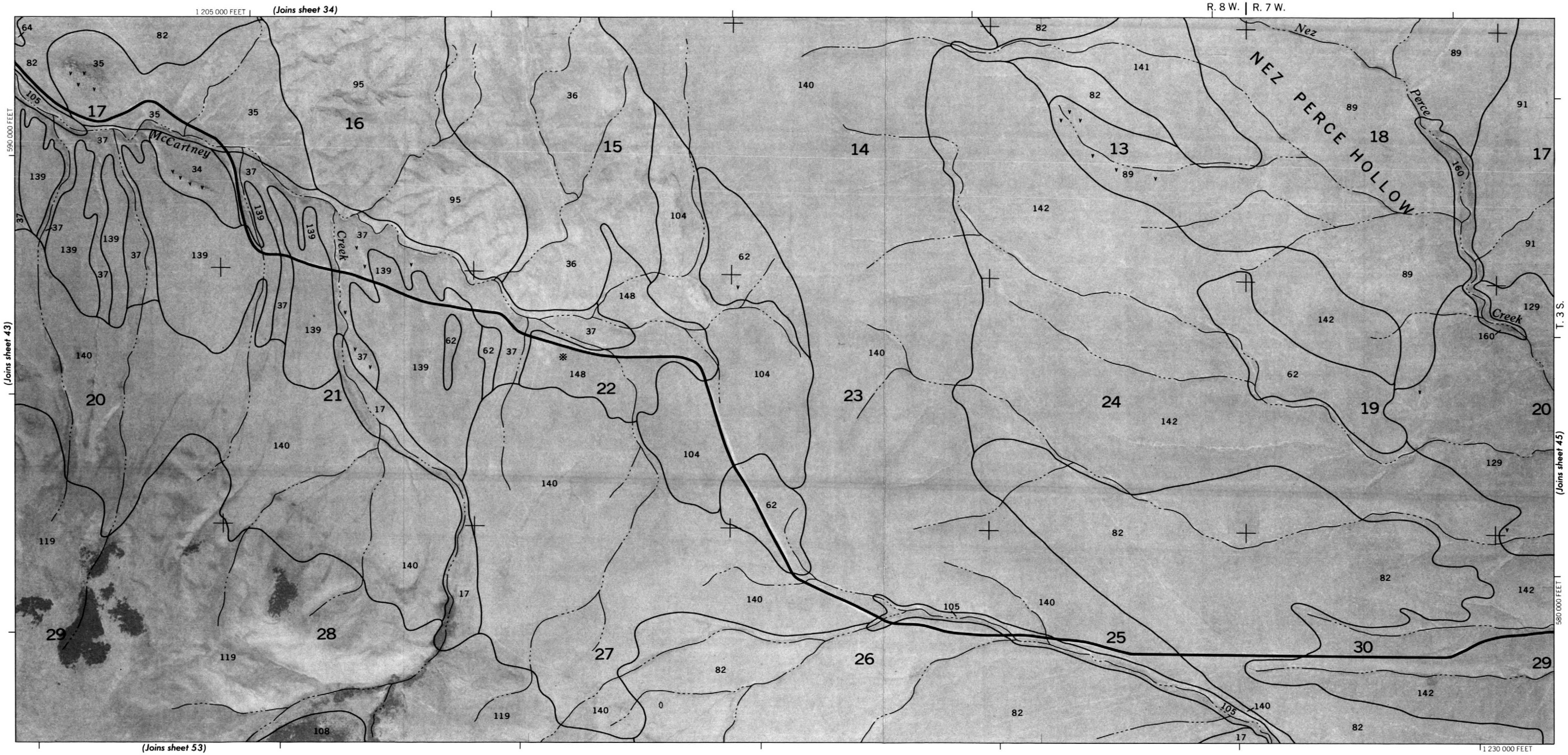


SCALE 1:24 000



1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

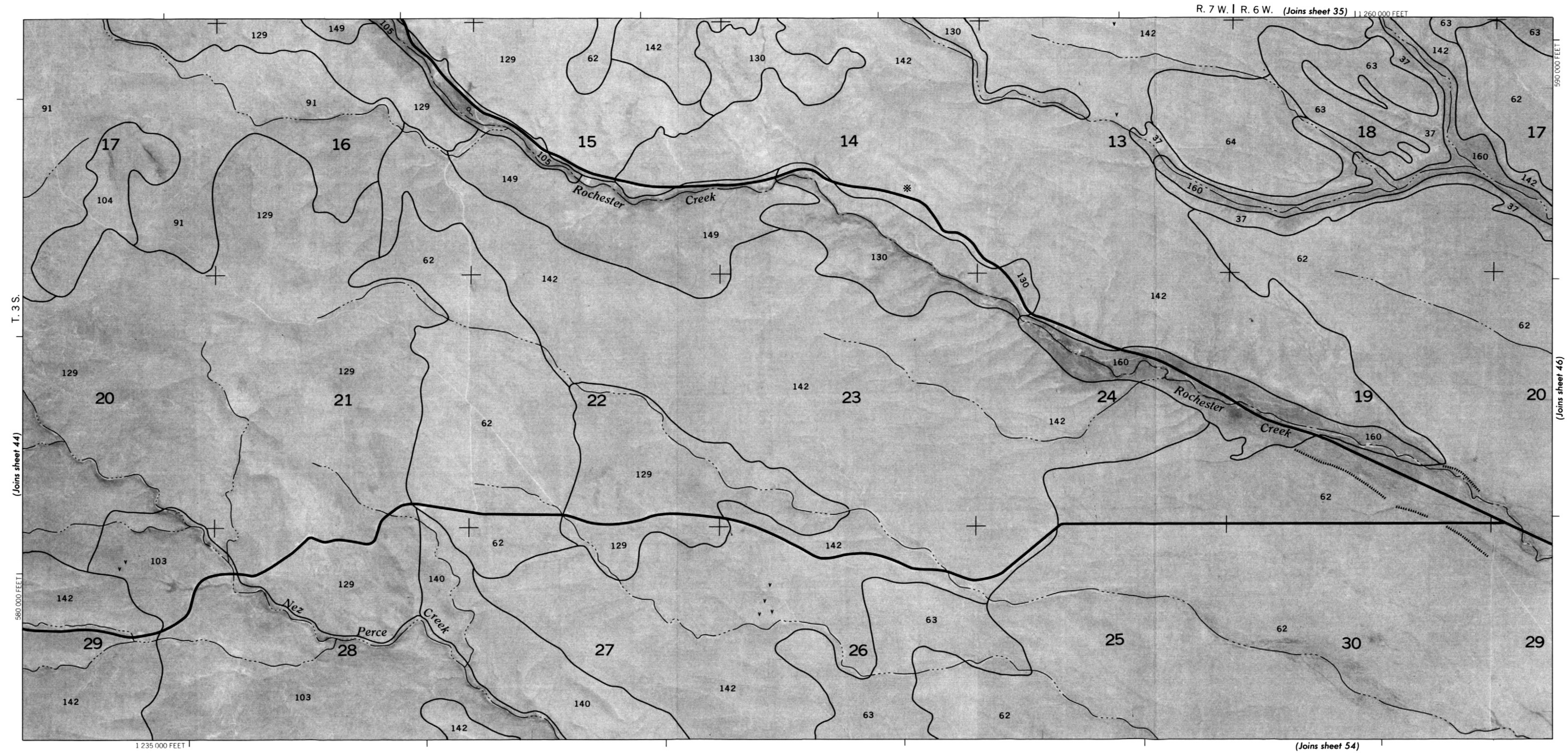
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 44



1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

45

N



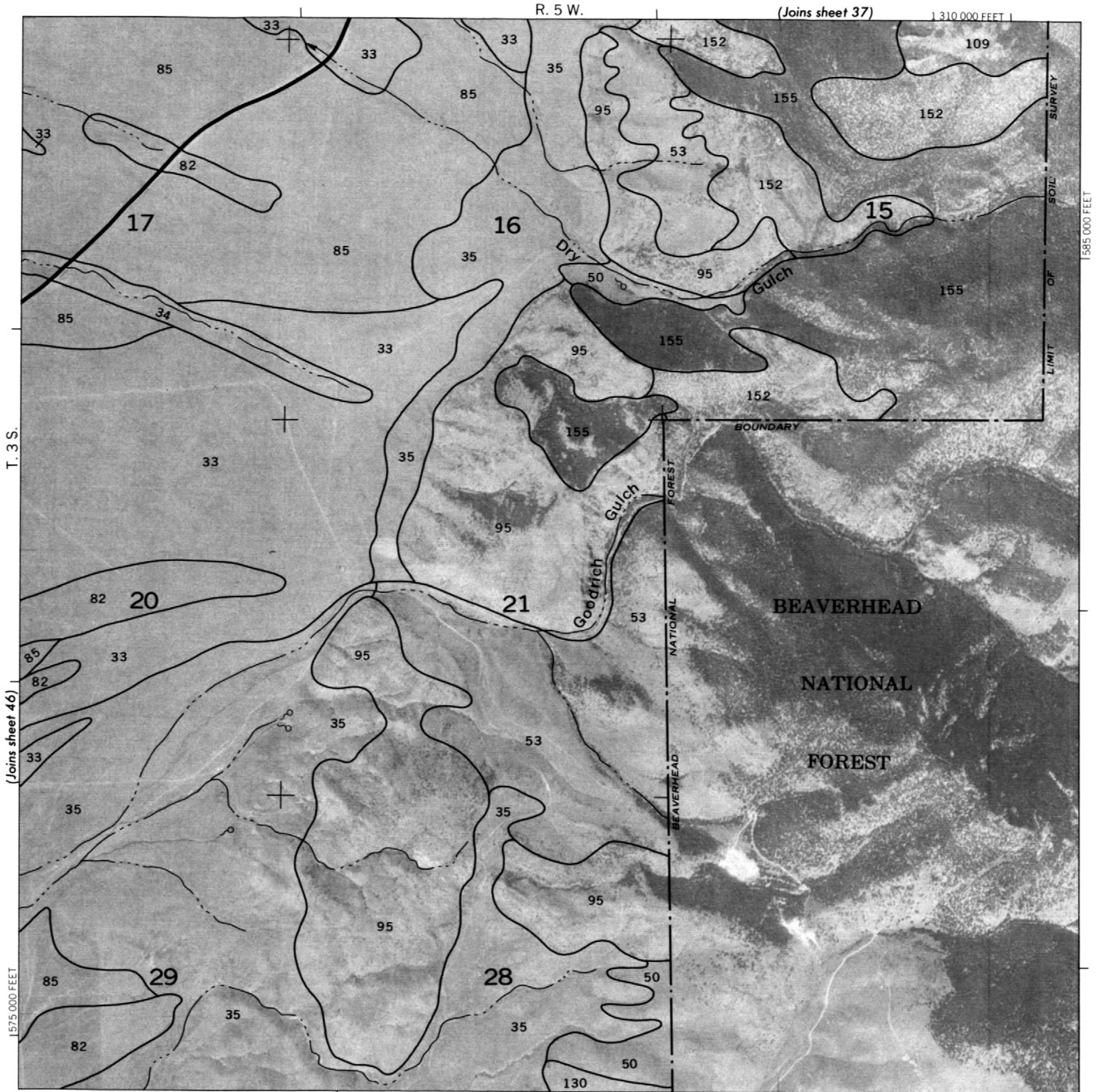
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

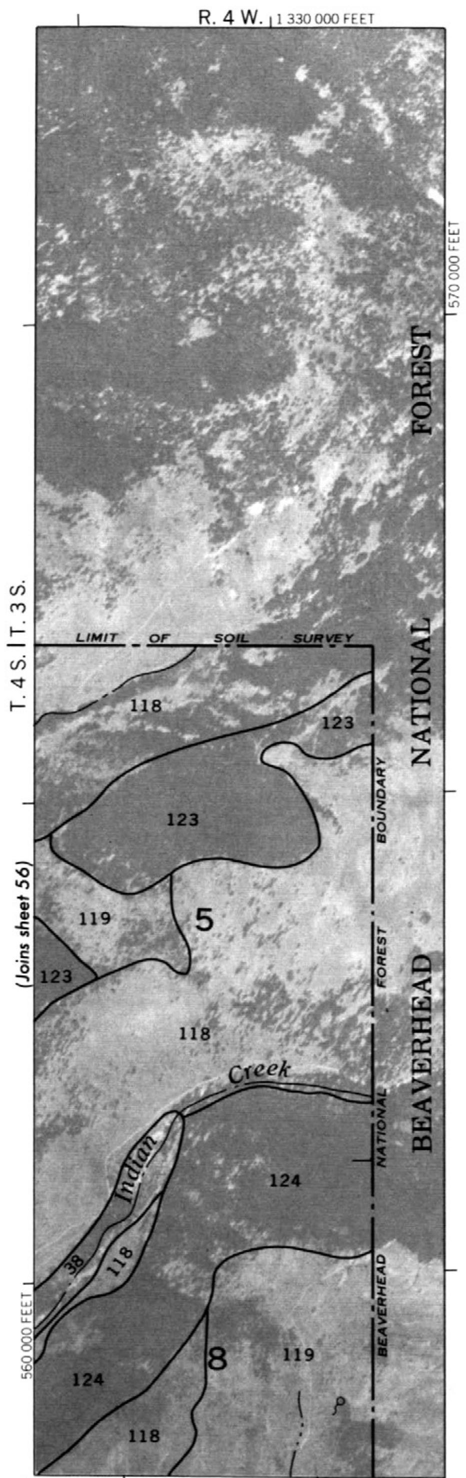
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 46

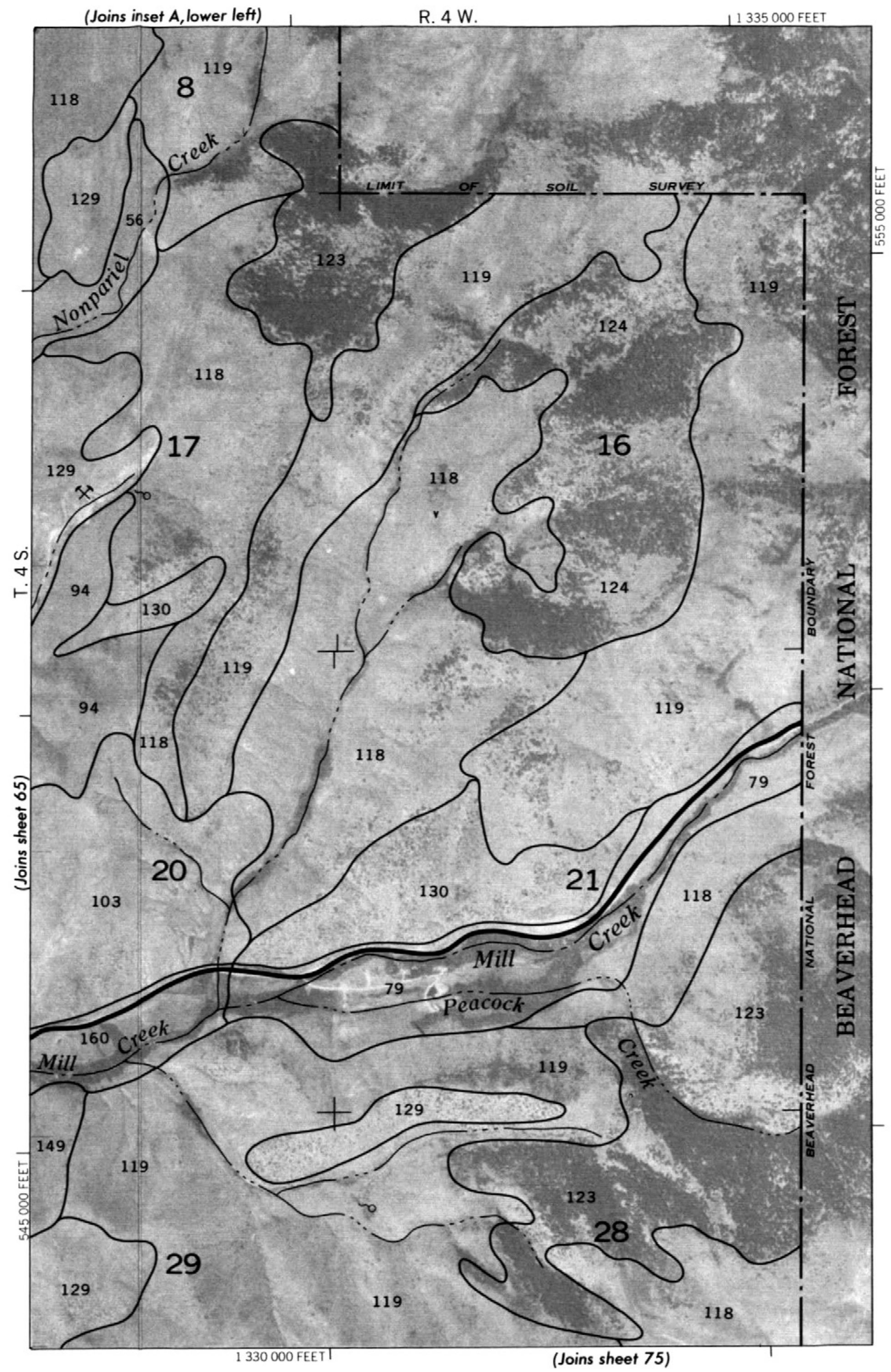
N



INSET A



INSET B



2000 AND 5000-FOOT GRID TICKS

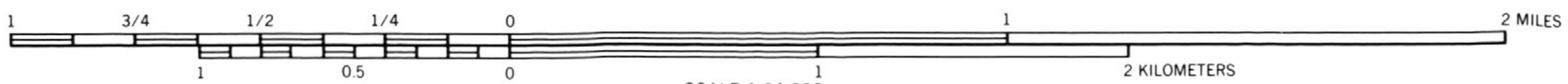
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

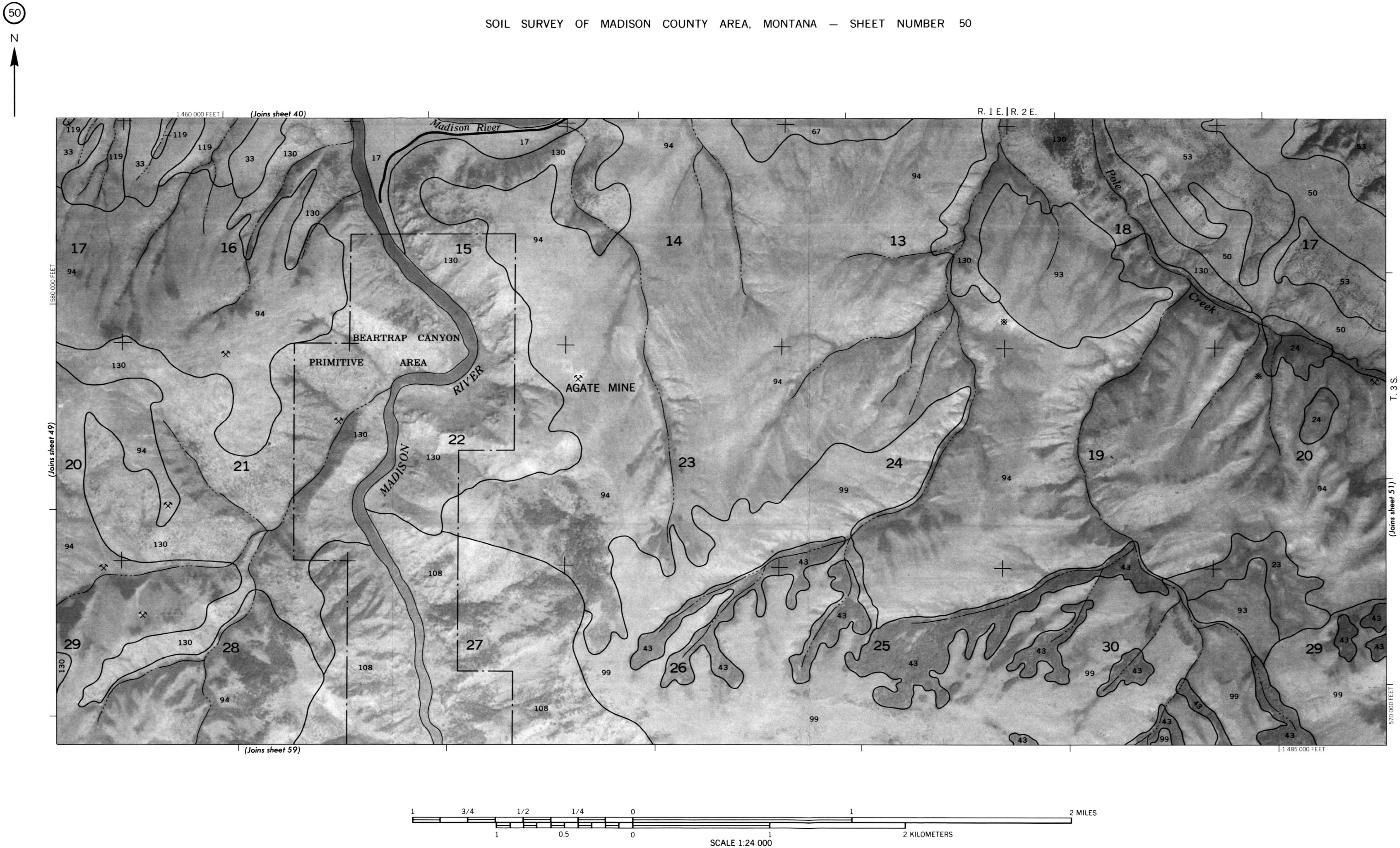
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 48

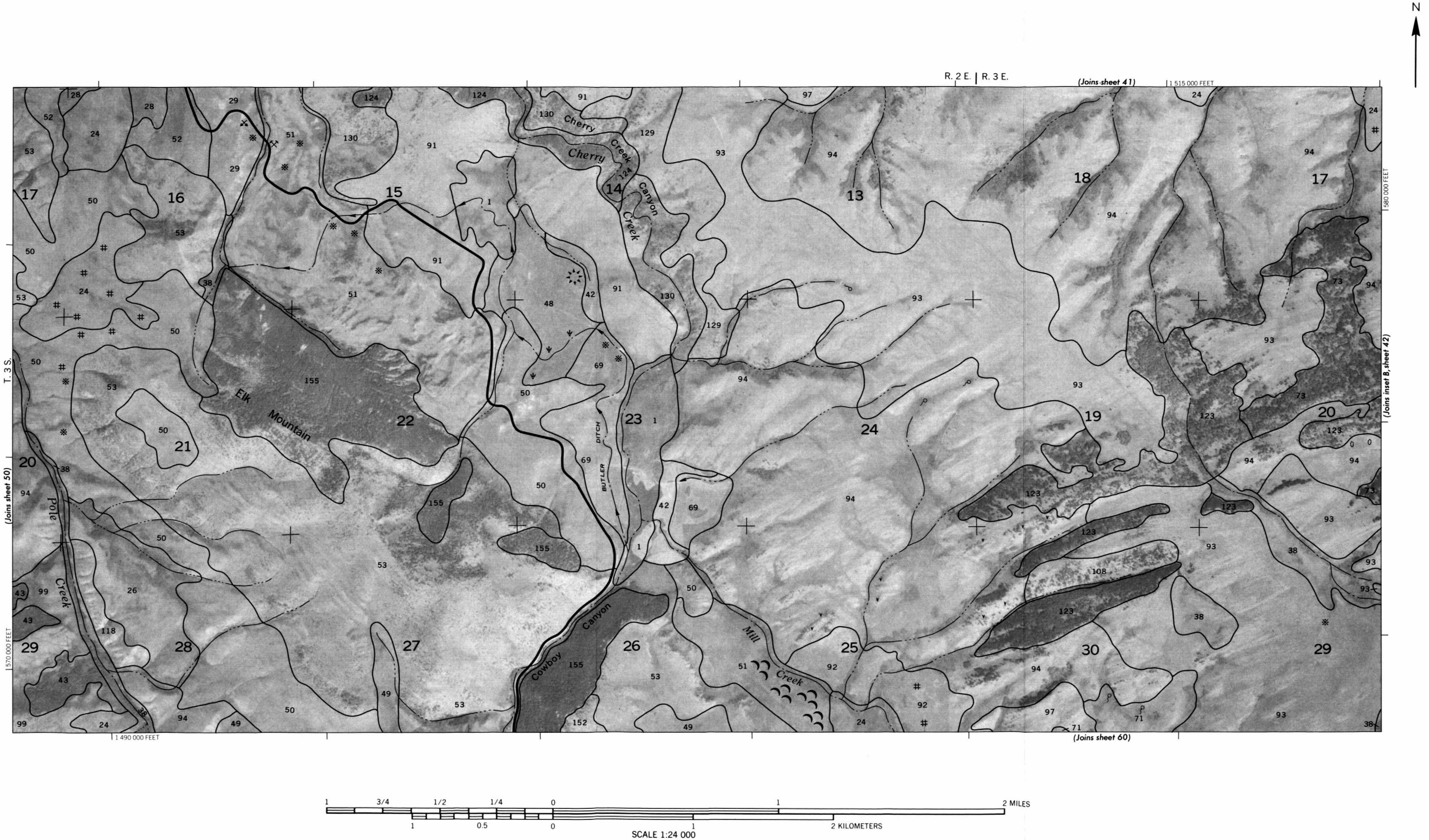
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000



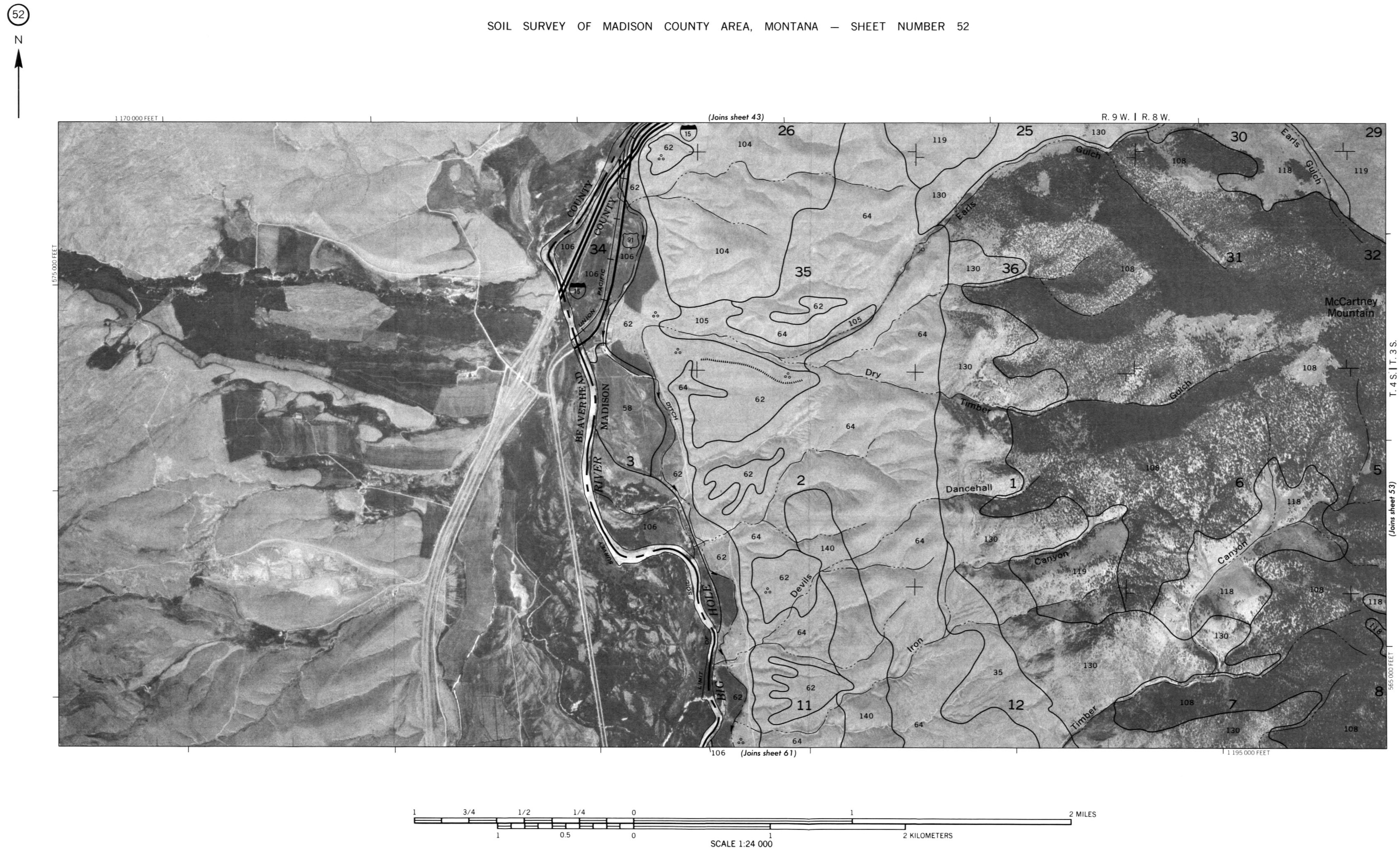
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 50

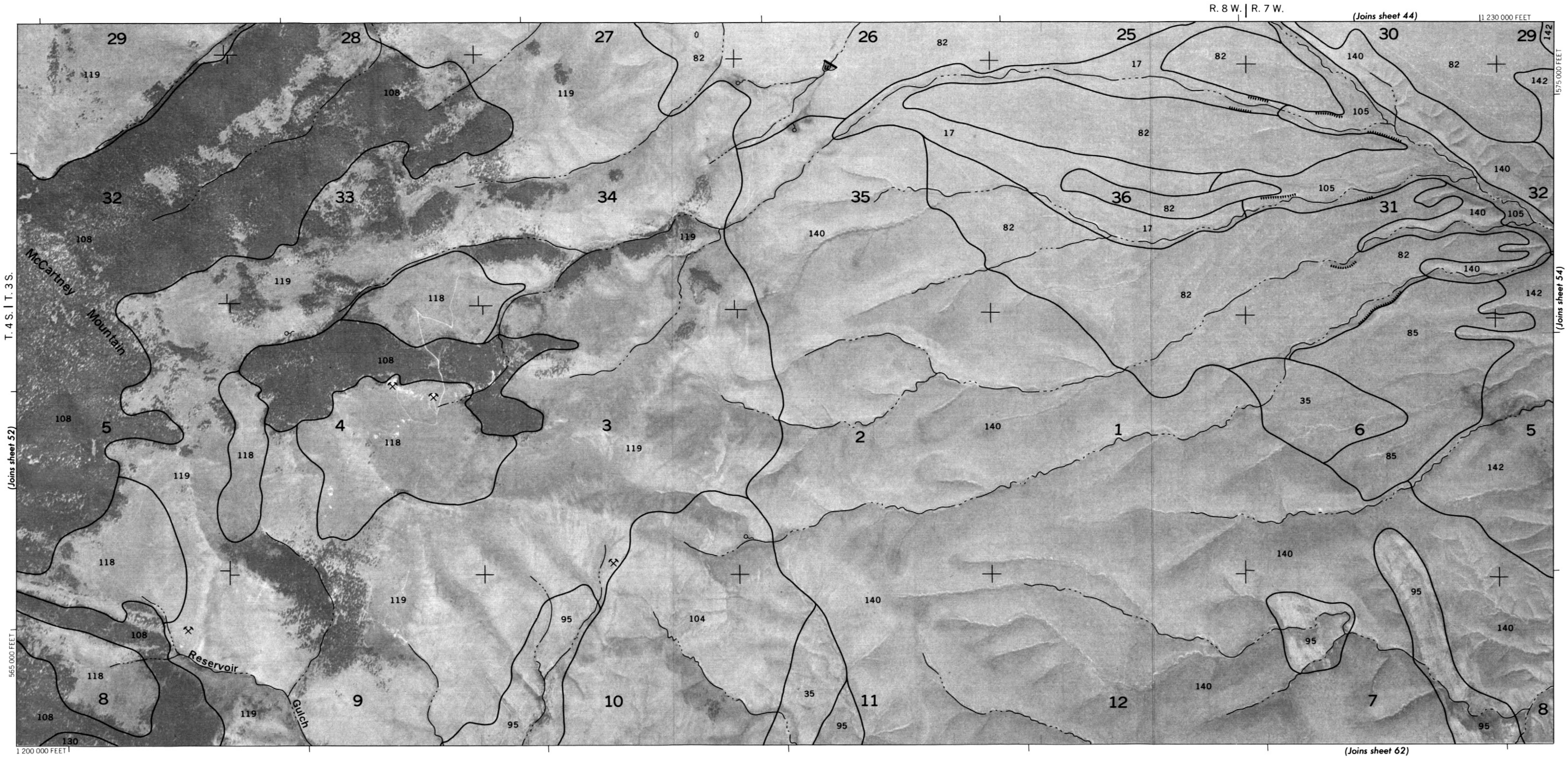



N
R. 2 E. | R. 3 E.
(Joins sheet 41)
1 515 000 FEET
580 000 FEET
(Joins inset B, sheet 42)
(Joins sheet 60)
1 490 000 FEET
570 000 FEET
(Joins sheet 50)
T. 3 S.
Cherry Creek
Cherry Creek Canyon
Elk Mountain
Pole Creek
Cowboy Canyon
Mill Creek
BUTLER DITCH
17
16
15
14
13
18
20
21
22
23
24
19
29
28
27
26
25
30
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 52



N



1 3/4 1/2 1/4 0 1 2 MILES

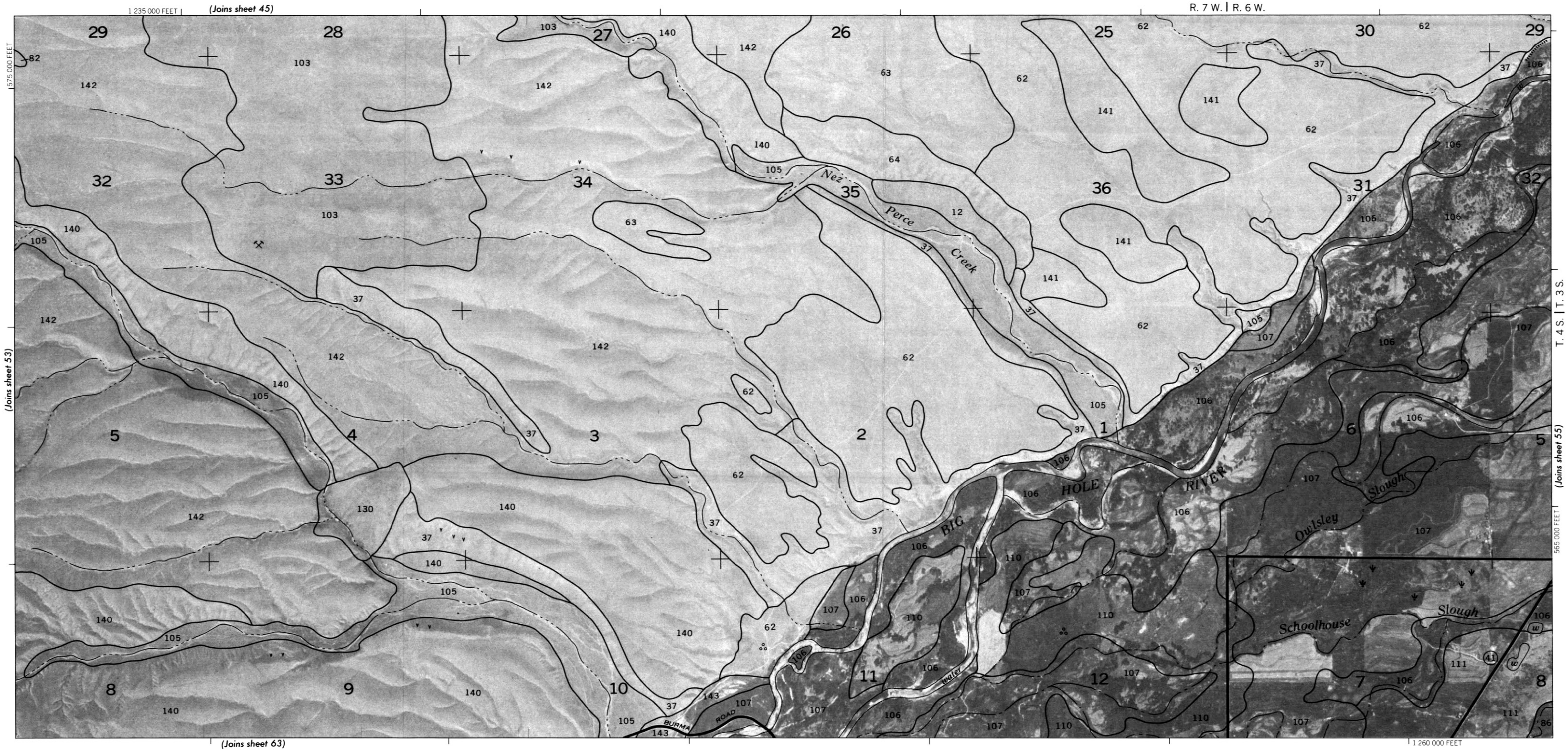
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

54

N

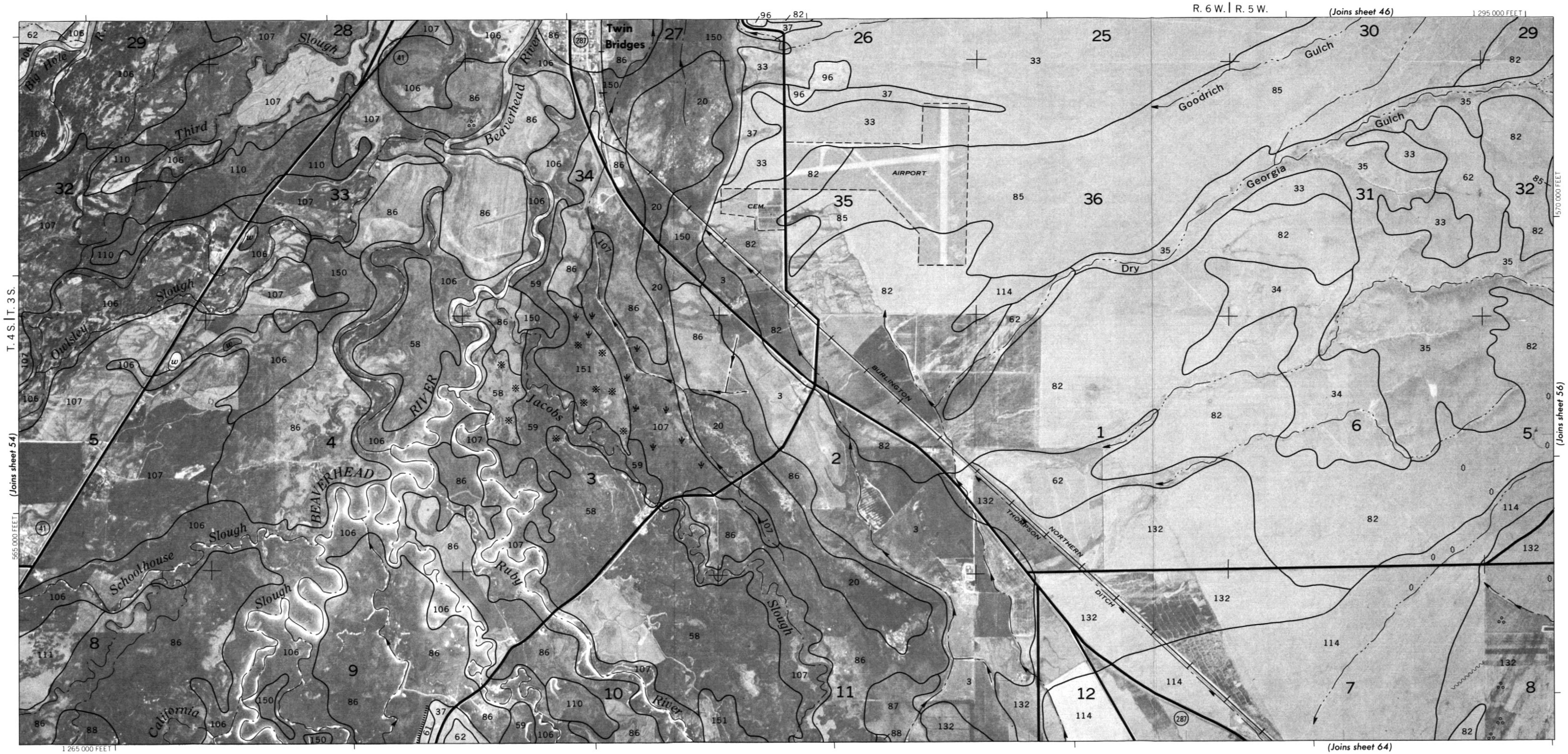
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 54



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

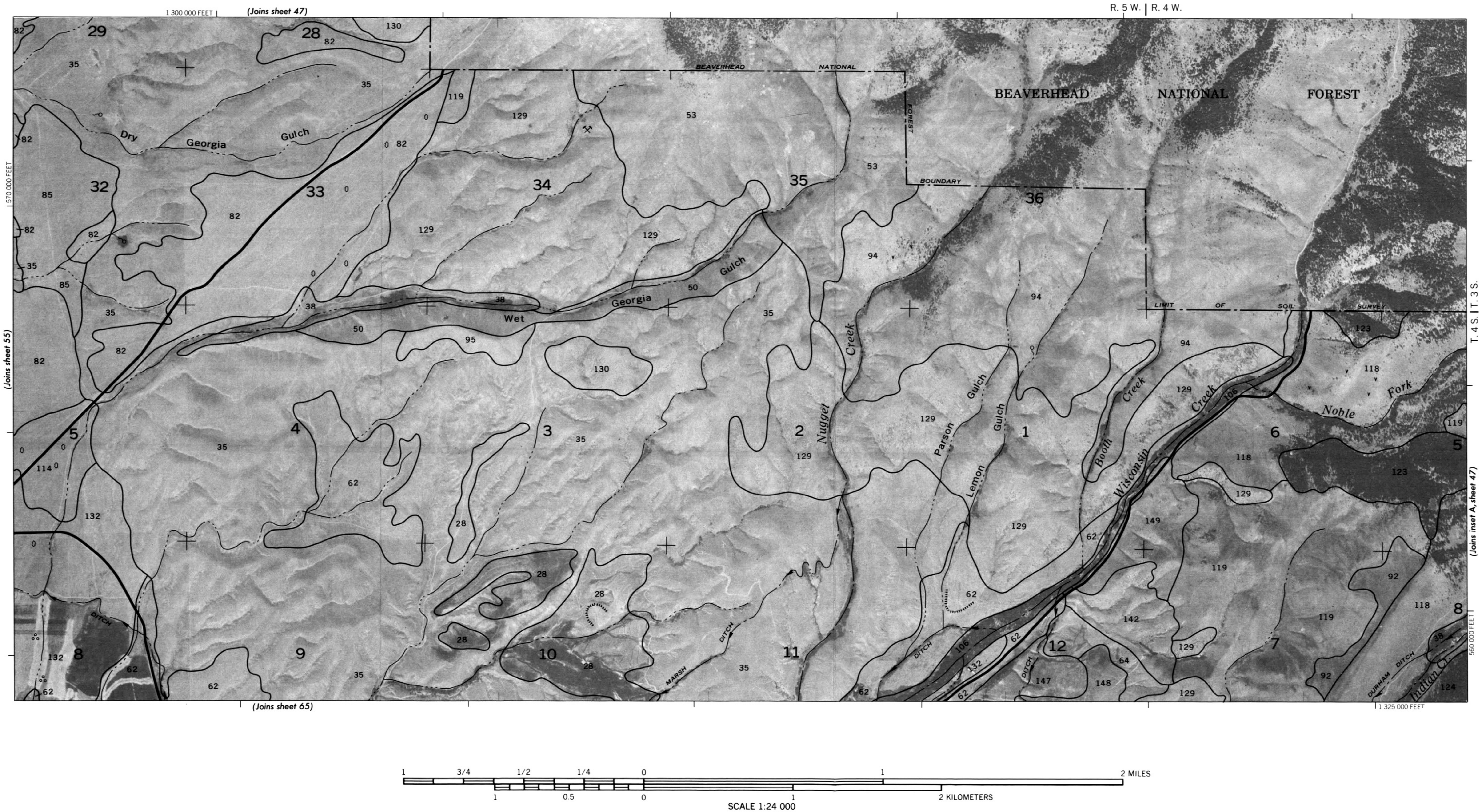


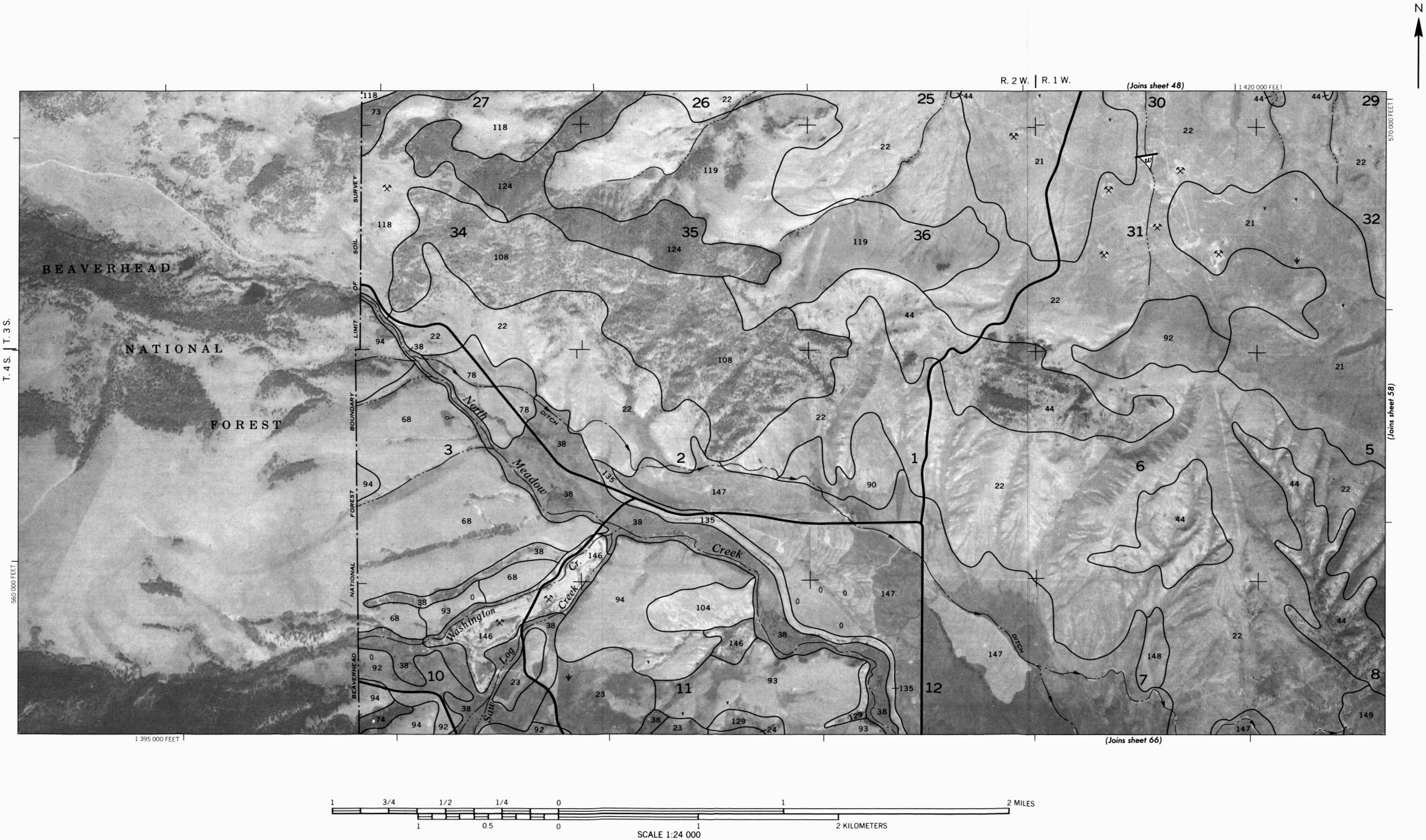
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

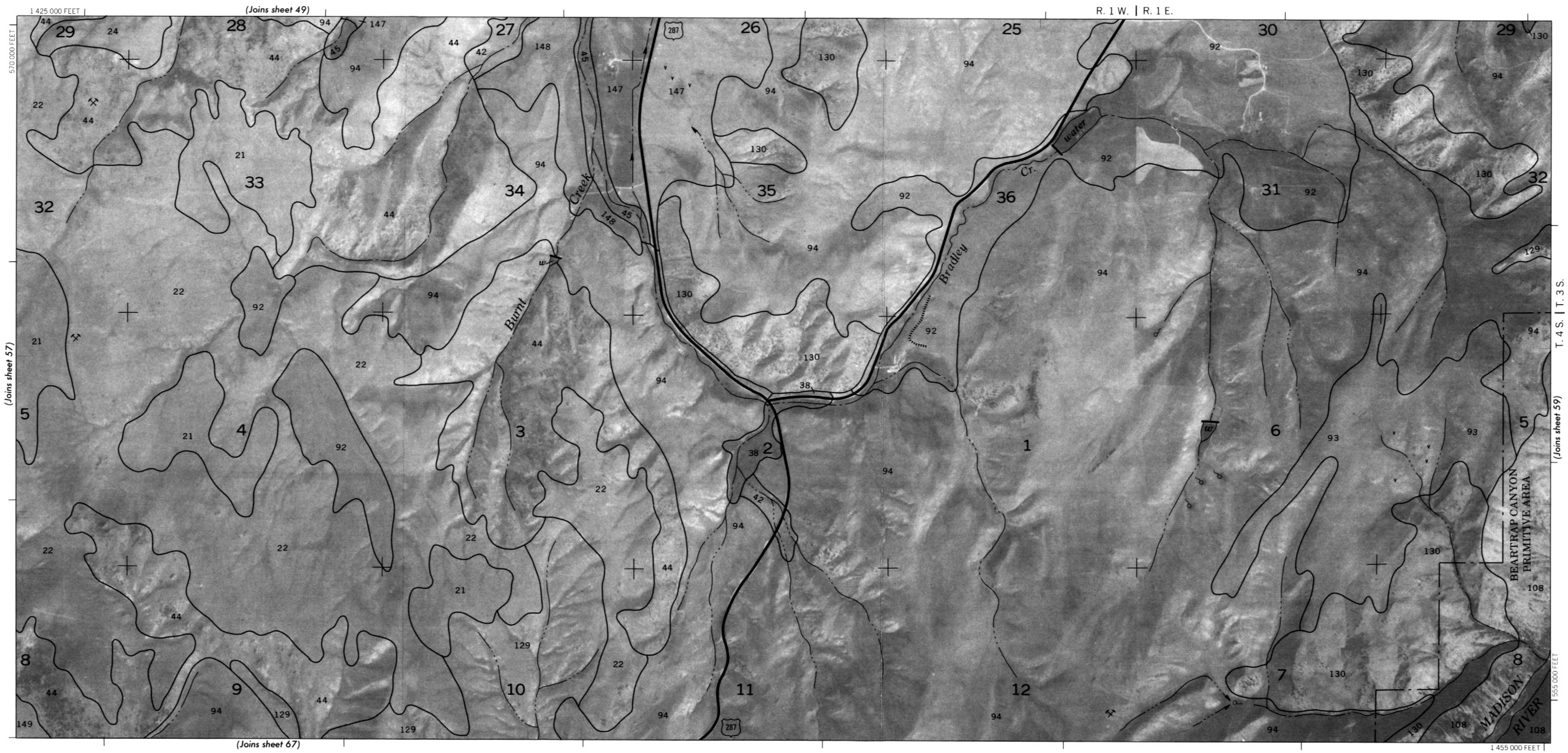
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 56




N
R. 2 W.
R. 1 W.
(Joins sheet 48)
(Joins sheet 58)
(Joins sheet 66)
T. 4 S.
T. 3 S.
1 420 000 FEET
570 000 FEET
560 000 FEET
1 395 000 FEET
BEAVERHEAD
NATIONAL
FOREST
LIMIT OF SOIL SURVEY
BEAVERHEAD NATIONAL FOREST BOUNDARY
North Meadow Creek
Washington Cr.
Saw Log Creek
DITCH
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 58



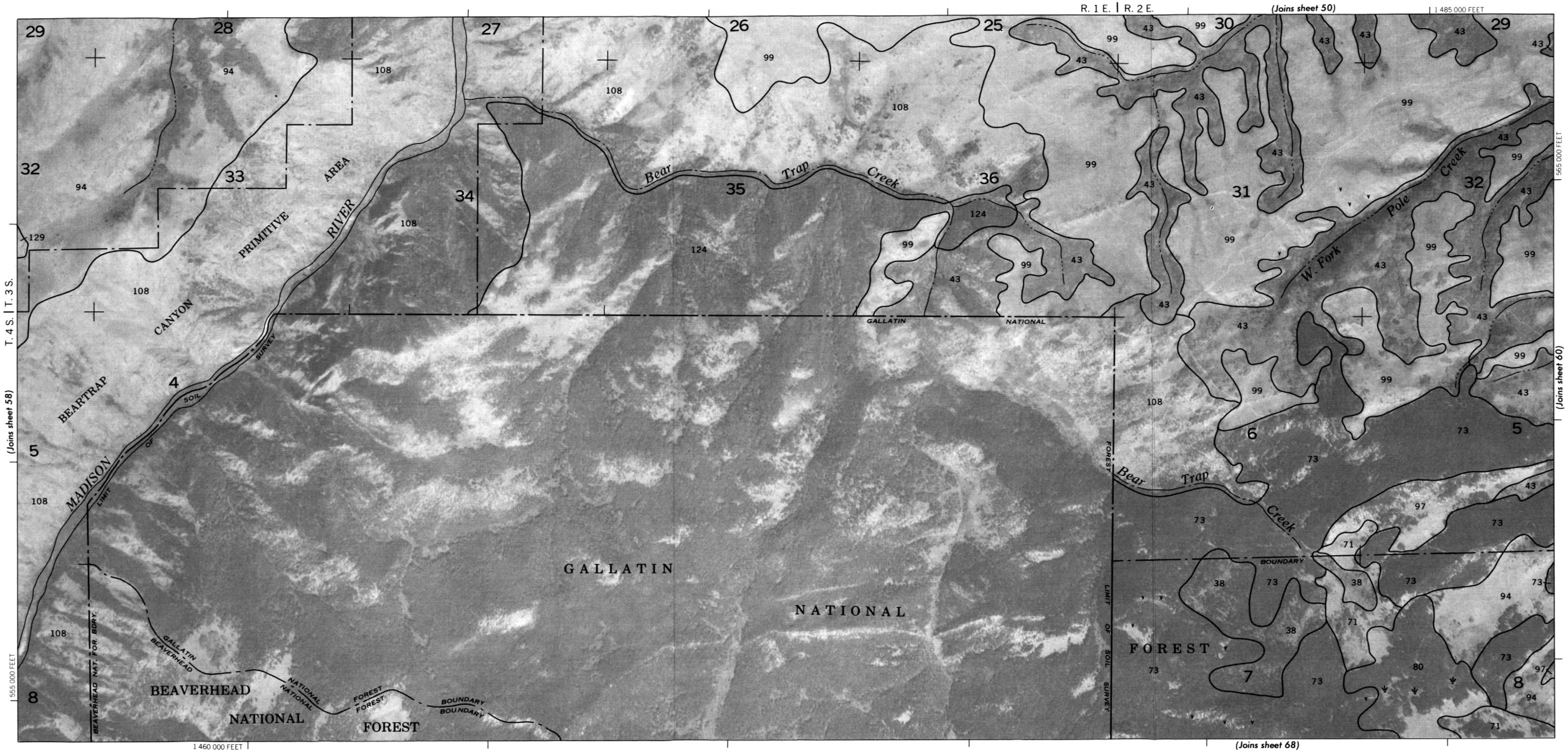
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

59

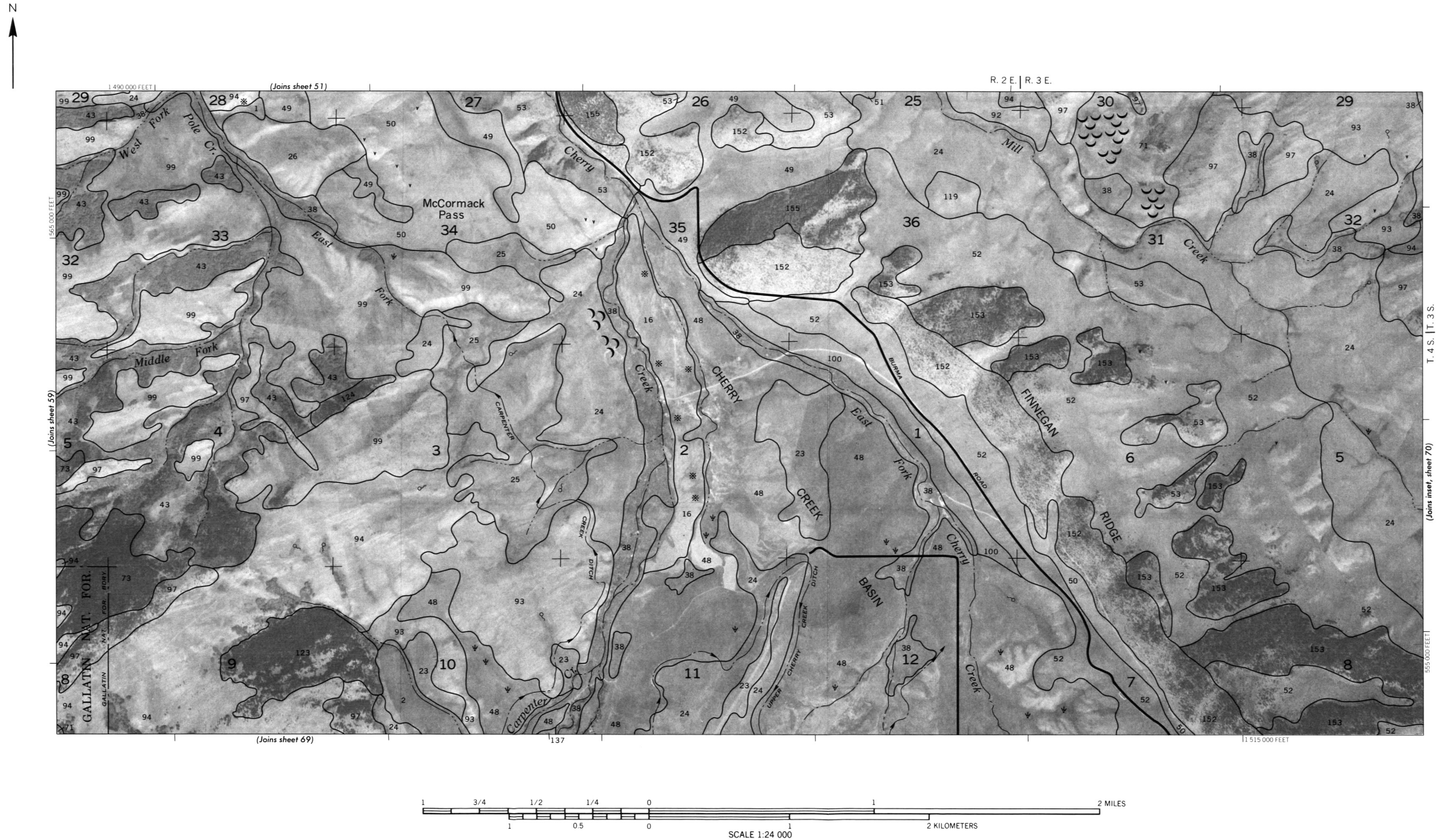
N

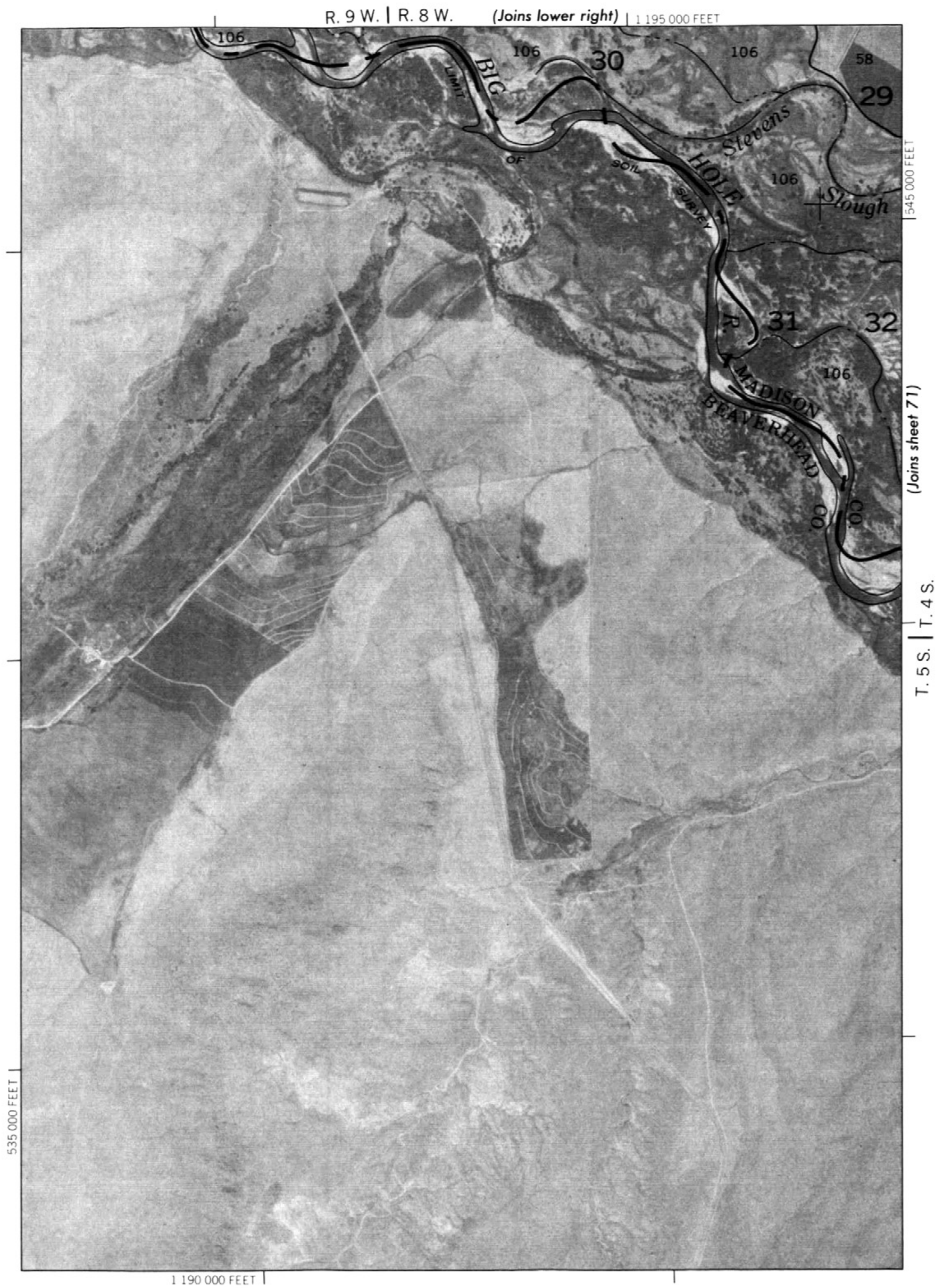


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

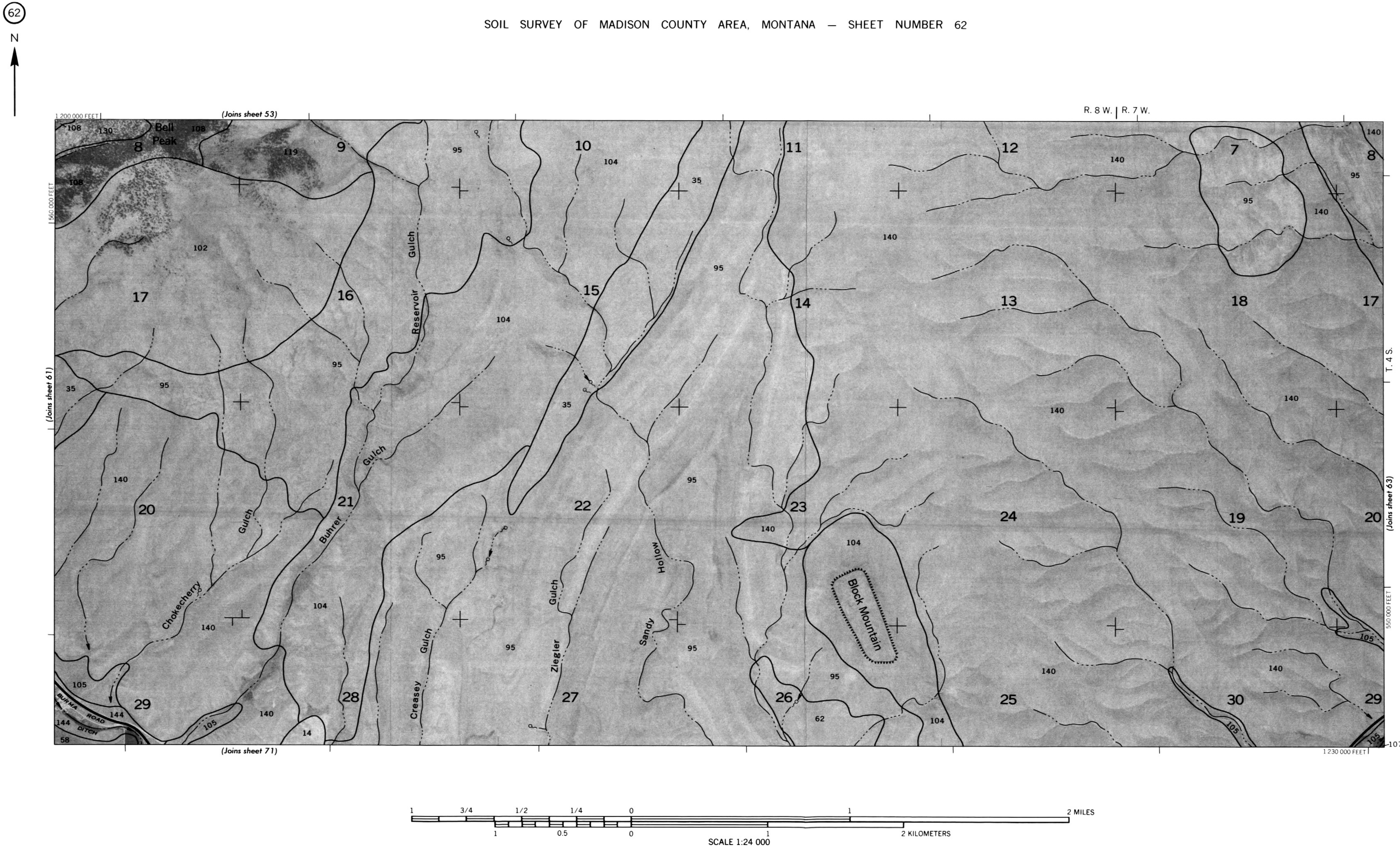

N
(Joins sheet 51)
(Joins sheet 59)
(Joins sheet 69)
(Joins inset, sheet 70)
R. 2 E. | R. 3 E.
T. 4 S. | T. 3 S.
1 490 000 FEET
565 000 FEET
555 000 FEET
1 515 000 FEET
McCormack Pass
West Fork Pole Cr.
East Fork
Middle Fork
Cherry Creek
CHERRY CREEK
East Fork Cherry Creek
BURMA ROAD
FINNEGAN RIDGE
Mill Creek
CARPENTER CREEK DITCH
Carpenter Cr.
UPPER CHERRY CREEK DITCH
BASIN
GALLATIN NAT. FOR.
GALLATIN NAT. FOR. BDRY
137
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000



SCALE 1:24 000

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS


62
N
1 200 000 FEET
(Joins sheet 53)
R. 8 W. | R. 7 W.
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 71)
T. 4 S.
560 000 FEET
550 000 FEET
1 230 000 FEET
107
Bell Peak
Reservoir Gulch
Buhrer Gulch
Chokecherry Gulch
Creasey Gulch
Ziegler Gulch
Sandy Hollow
Block Mountain
BURMA ROAD DITCH
8
9
10
11
12
7
8
17
16
15
14
13
18
17
20
21
22
23
24
19
20
29
28
27
26
25
30
29
108
130
108
119
108
102
95
104
35
140
95
35
95
104
35
95
140
140
95
140
140
140
95
95
104
140
95
105
144
144
58
105
140
14
104
95
95
95
62
104
140
140
105
105
105
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24 000

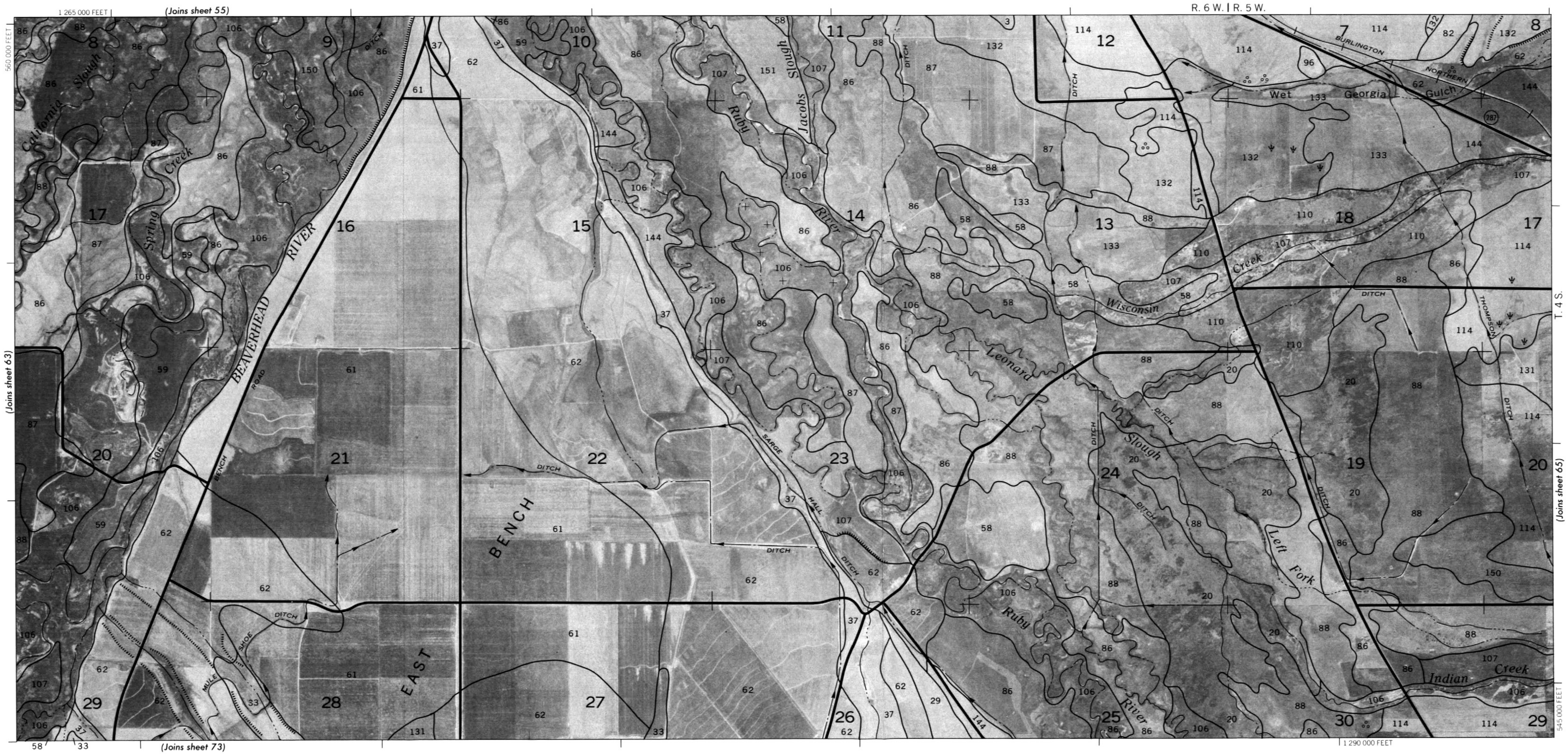
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 64

N



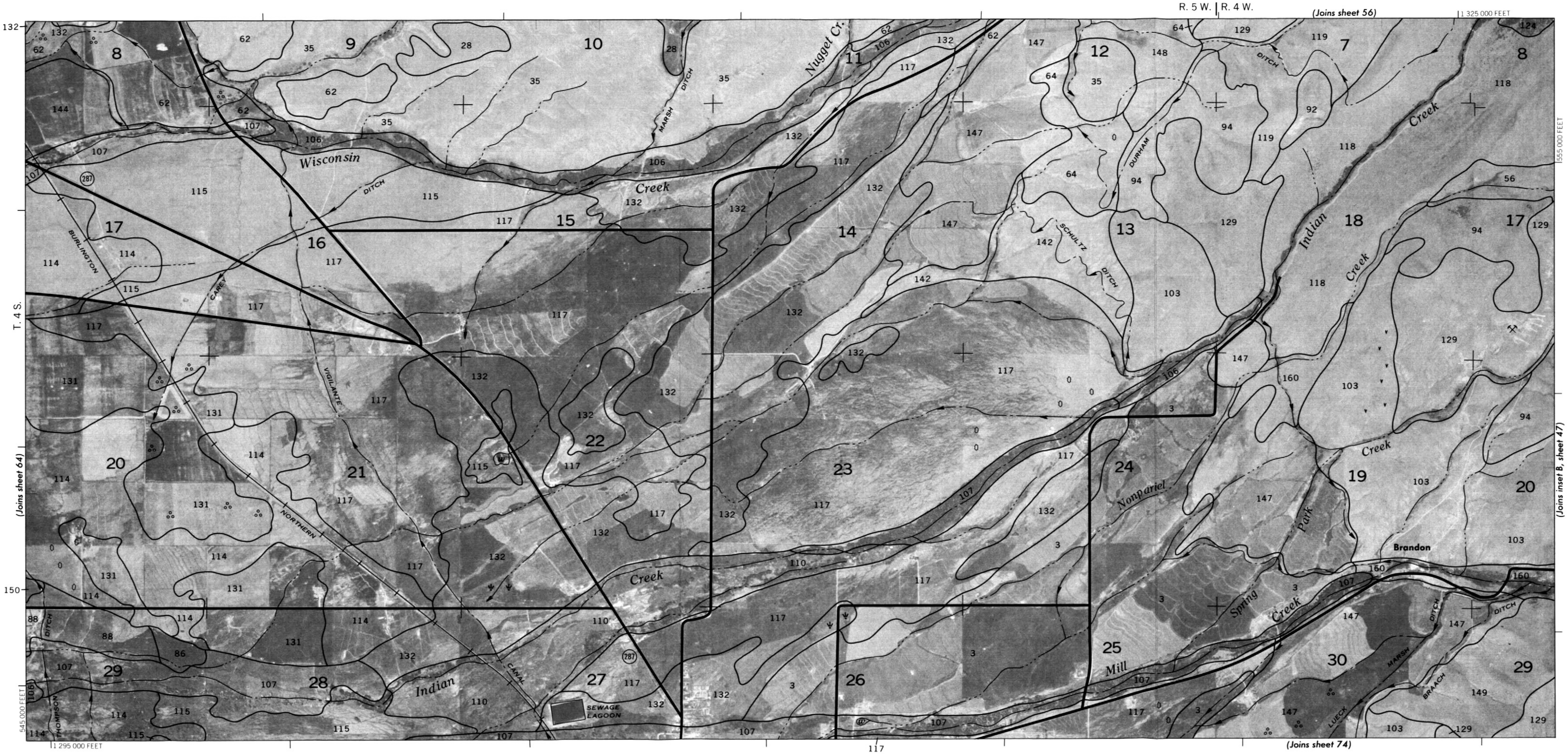
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

65

N



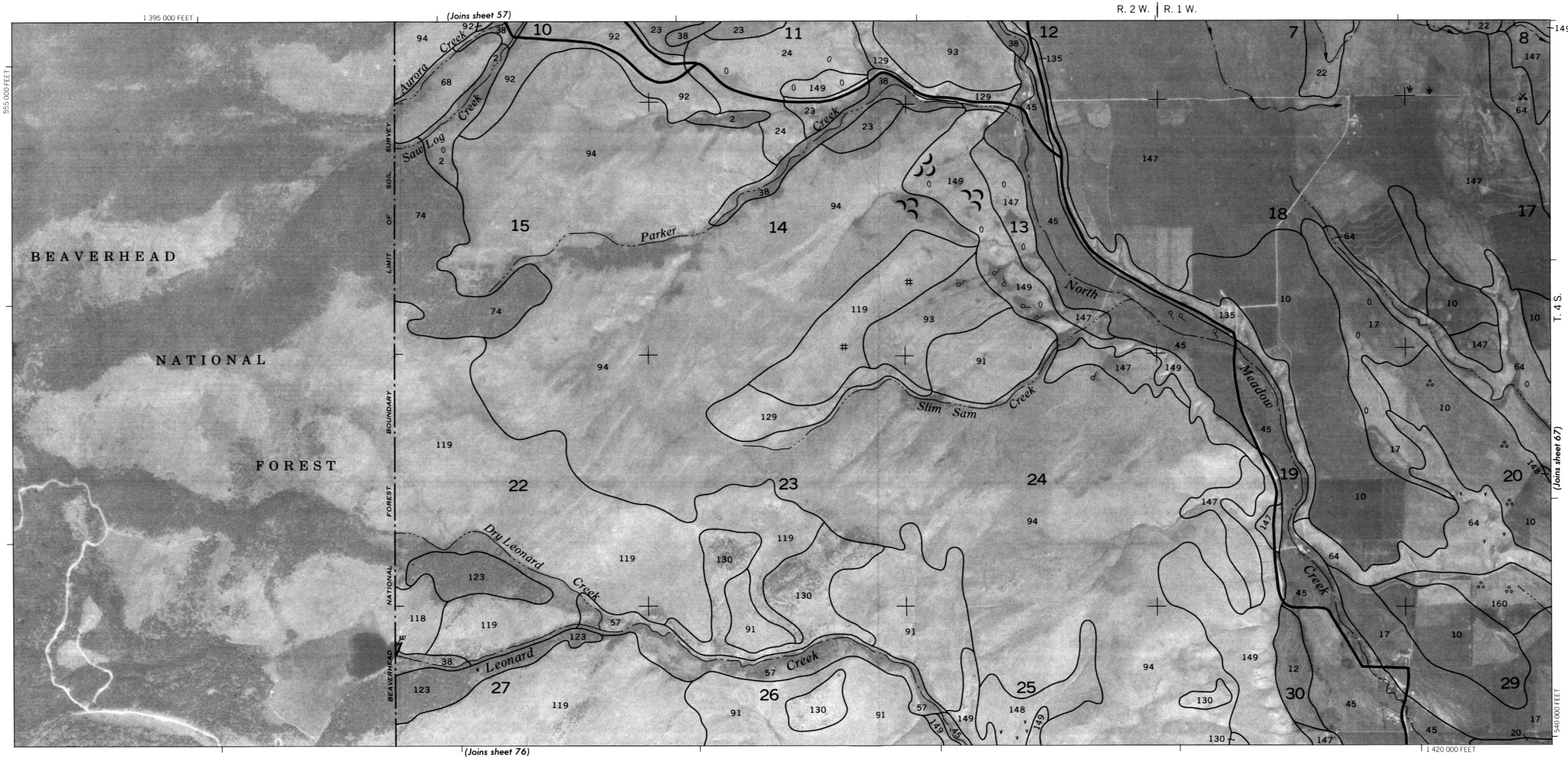
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

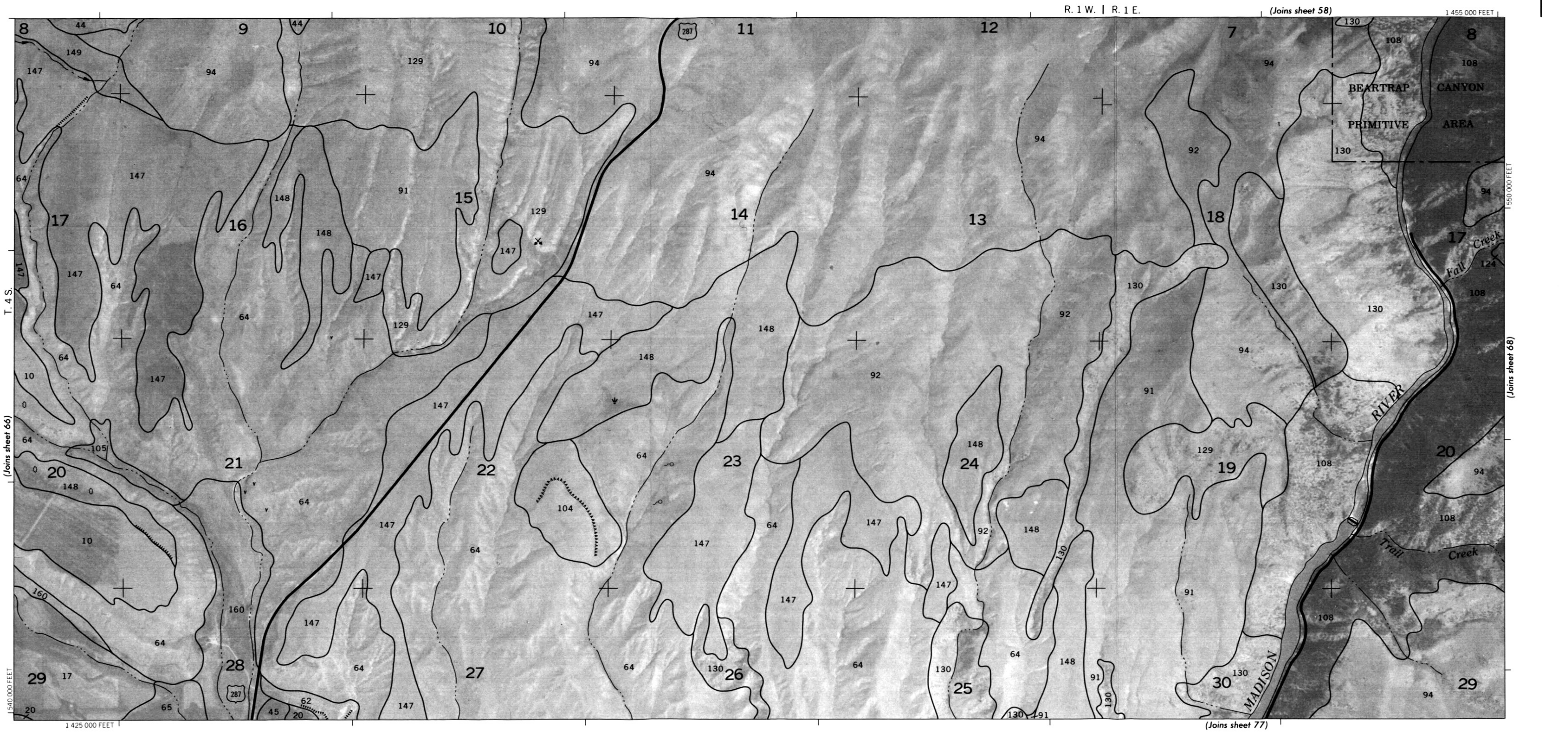
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 66



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

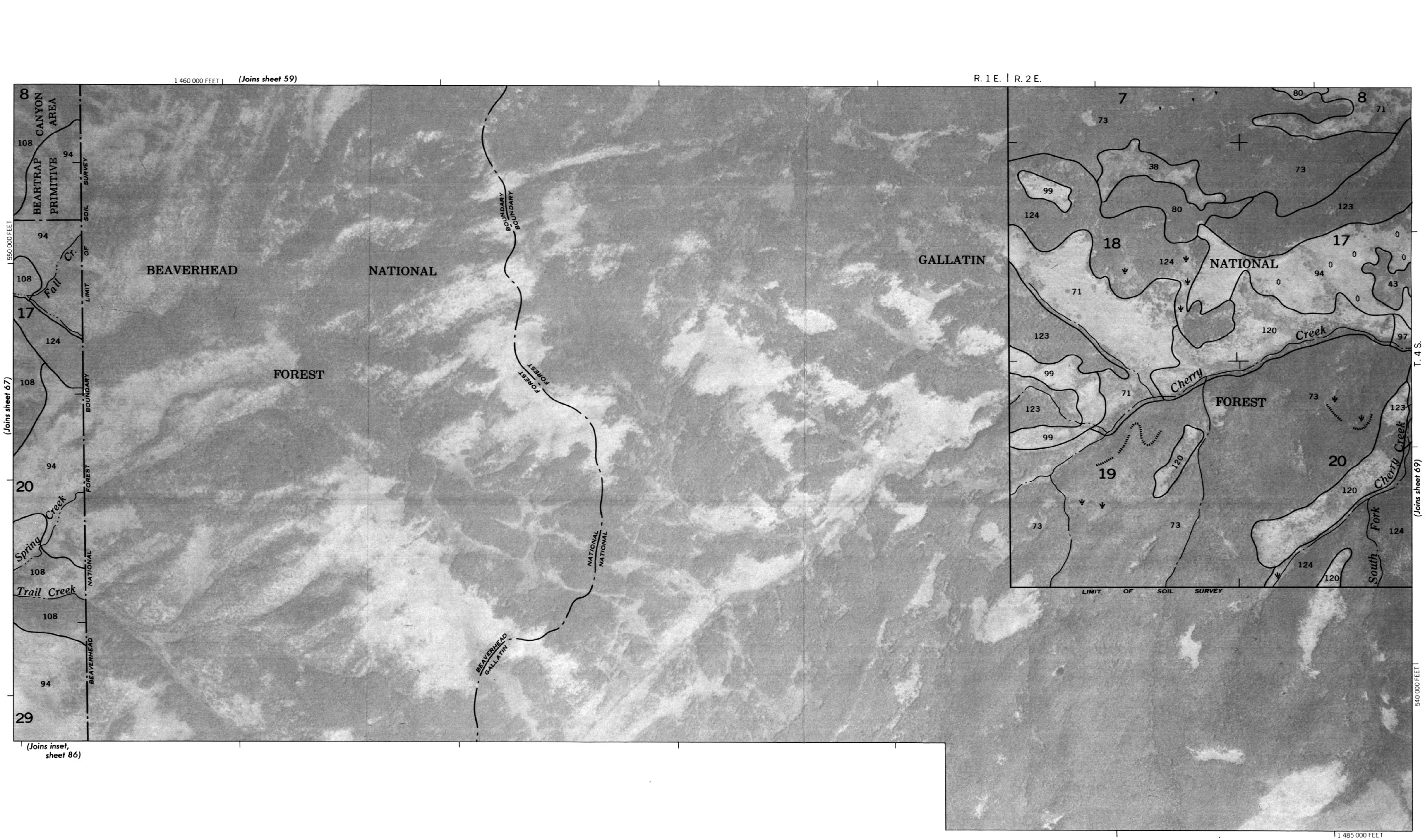
SCALE 1:24 000



1 3/4 1/2 1/4 0 1 2 MILES

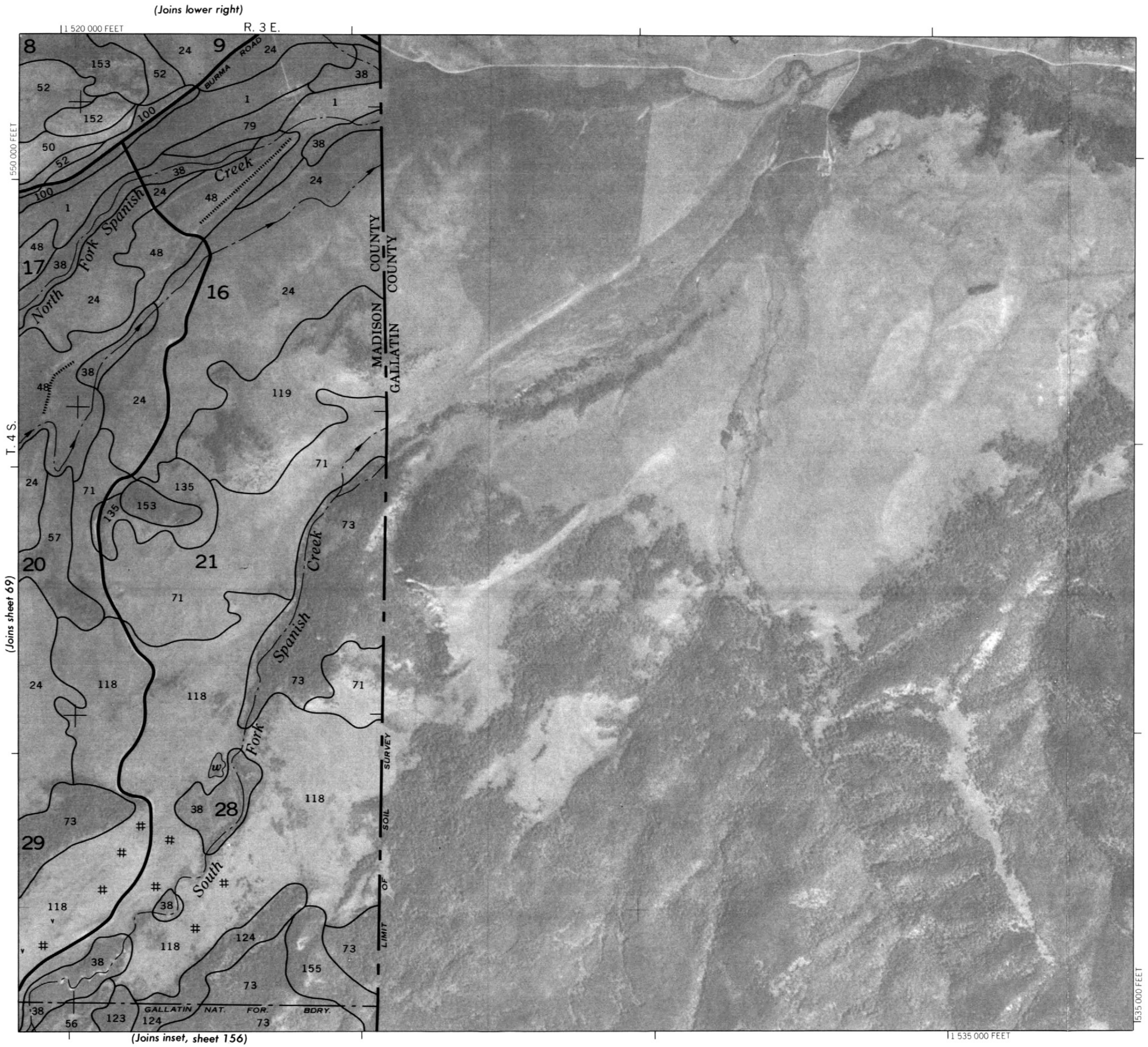
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

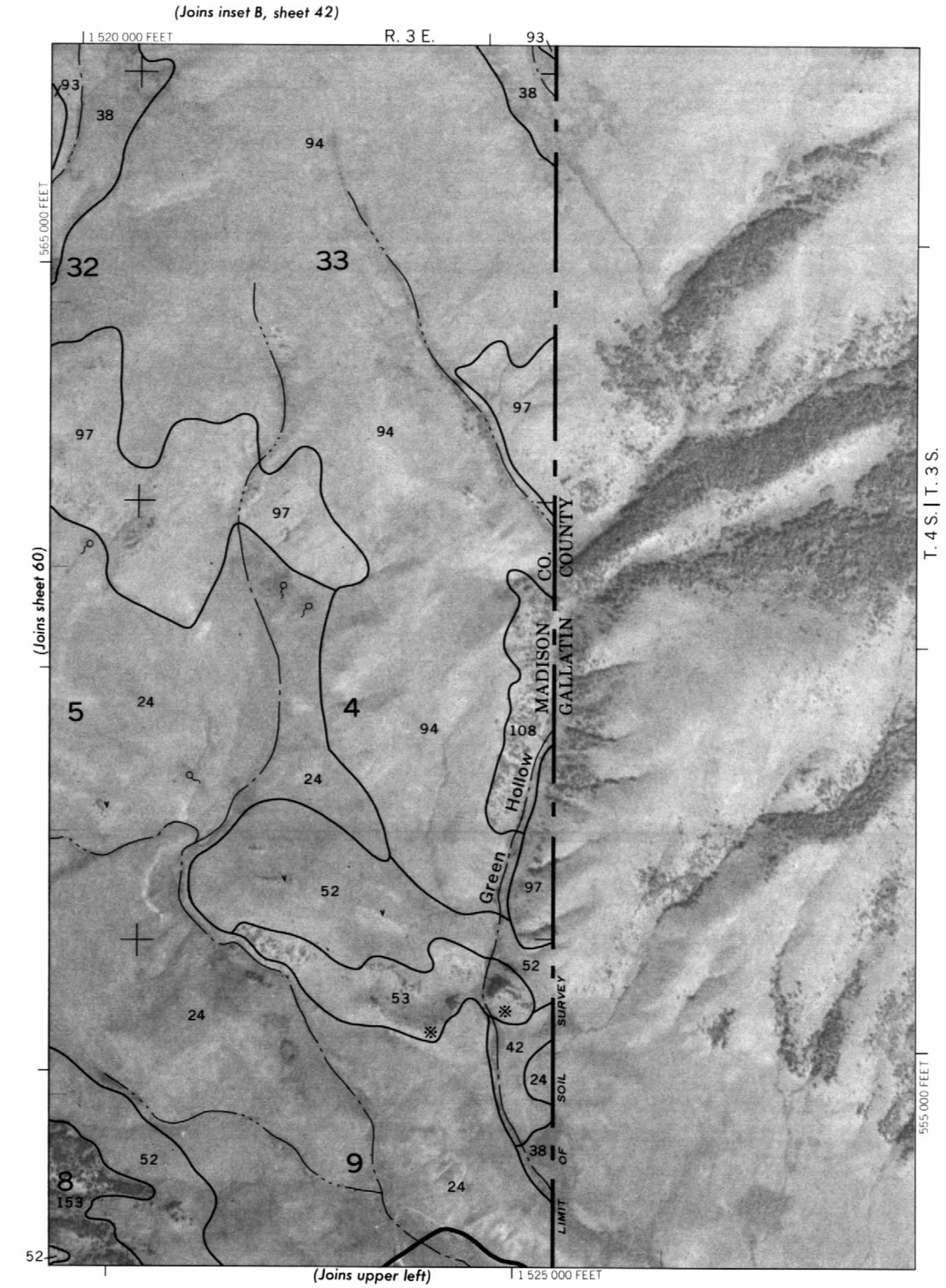

N
1 460 000 FEET
(Joins sheet 59)
R. 1 E. | R. 2 E.
BEARTRAP CANYON PRIMITIVE AREA
LIMIT OF SOIL SURVEY
BEAVERHEAD
NATIONAL
FOREST
GALLATIN
NATIONAL
FOREST
BEAVERHEAD NATIONAL FOREST BOUNDARY
GALLATIN NATIONAL FOREST BOUNDARY
Fall Cr.
Spring Creek
Trail Creek
Cherry Creek
South Fork Cherry Creek
550 000 FEET
540 000 FEET
1 485 000 FEET
(Joins sheet 67)
(Joins sheet 69)
(Joins inset, sheet 86)
T. 4 S.
LIMIT OF SOIL SURVEY
8
17
20
29
7
18
19
20
17
8
108
94
124
73
80
71
38
99
123
0
43
120
97

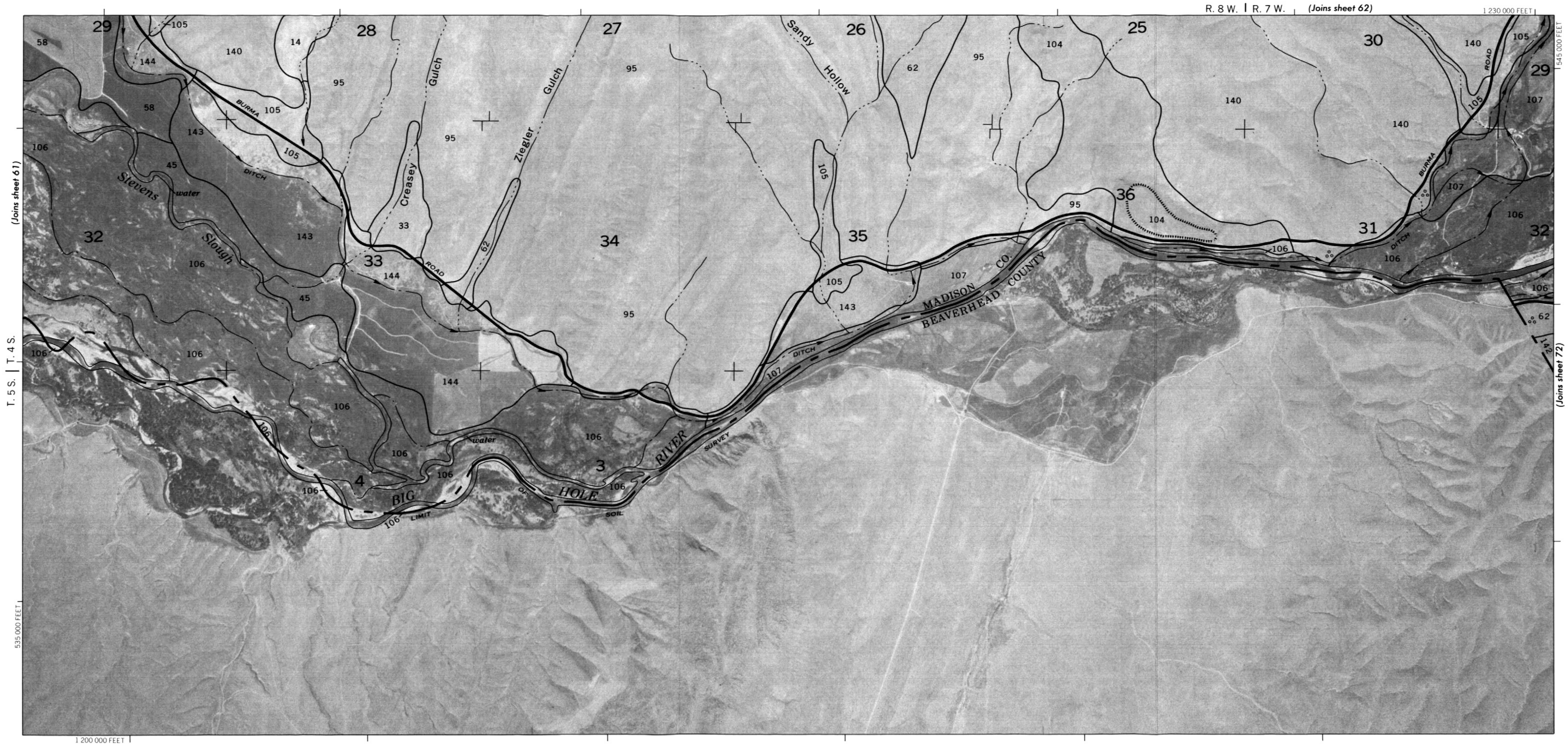

69
N
R. 2 E. | R. 3 E.
(Joins sheet 60)
1 515 000 FEET
550 000 FEET
(Joins sheet 68)
(Joins sheet 70)
(Joins inset, sheet 32)
1 490 000 FEET
540 000 FEET
T. 4 S.
Carpenter Creek
Cherry Creek
CHERRY CREEK BASIN
Cherry Creek
East Fork
FINNEGAN RIDGE
BURMA ROAD
Spanish Creek
Creek
Sweden Creek
So. Fork
GALLATIN NATIONAL FOREST BOUNDARY
GALLATIN
NATIONAL
FOREST
LIMIT OF SOIL SURVEY
Willow Swamp
Swamp Creek
Willow
North Fork
Cuff
GALLATIN NATIONAL FOREST BOUNDARY

N


(Joins lower right)
1 520 000 FEET
R. 3 E.
550 000 FEET
T. 4 S.
(Joins sheet 69)
BURMA ROAD
North Fork Spanish Creek
South Fork Spanish Creek
MADISON COUNTY
GALLATIN COUNTY
LIMIT OF SOIL SURVEY
GALLATIN NAT. FOR. BDRY.
8
9
16
17
20
21
28
29
535 000 FEET
1 535 000 FEET
(Joins inset, sheet 156)

INSET


(Joins inset B, sheet 42)
1 520 000 FEET
R. 3 E.
565 000 FEET
(Joins sheet 60)
T. 4 S. | T. 3 S.
Green Hollow
MADISON CO.
GALLATIN COUNTY
LIMIT OF SOIL SURVEY
32
33
5
4
8
9
555 000 FEET
(Joins upper left)
1 525 000 FEET

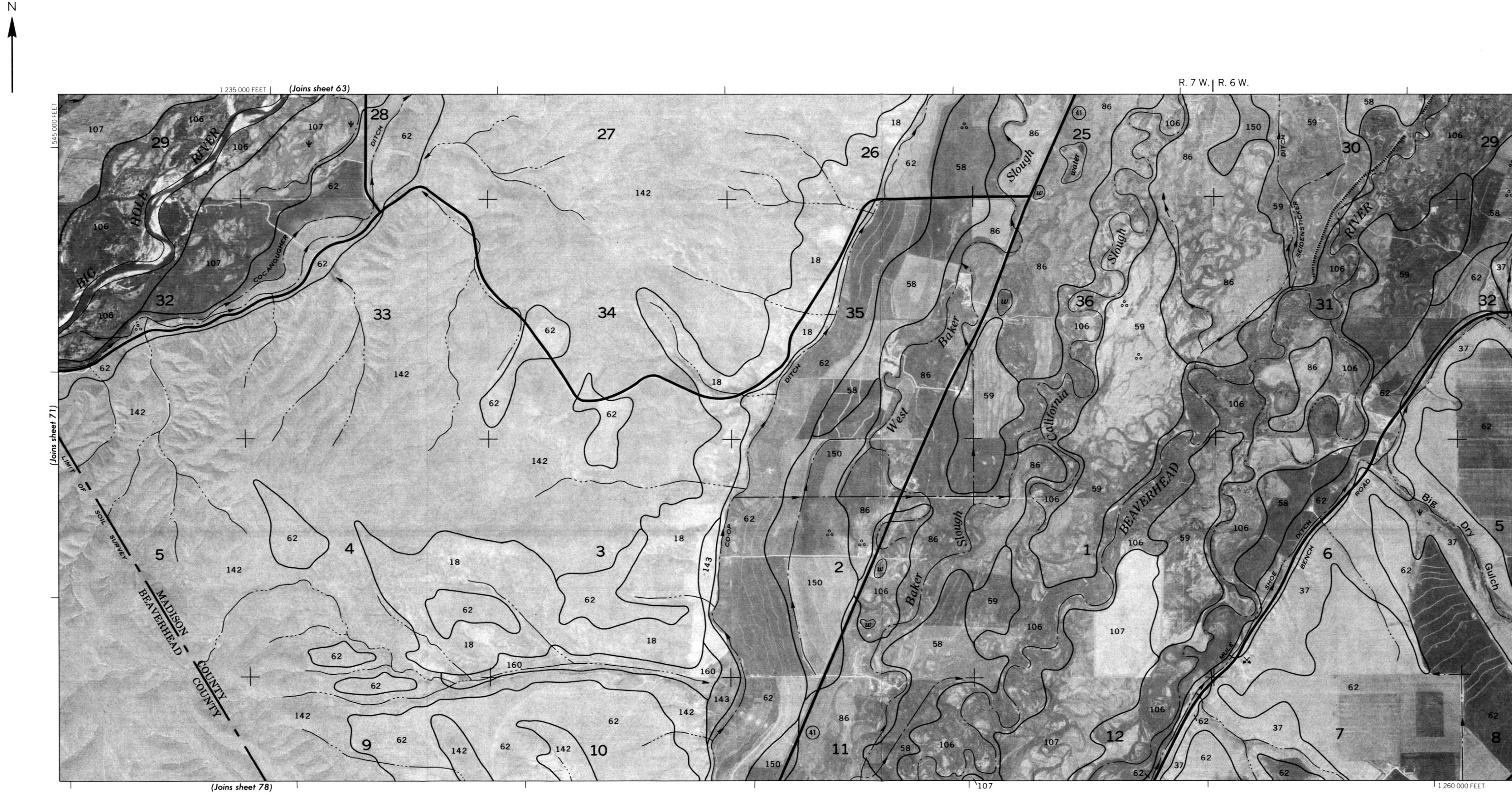


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 72



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

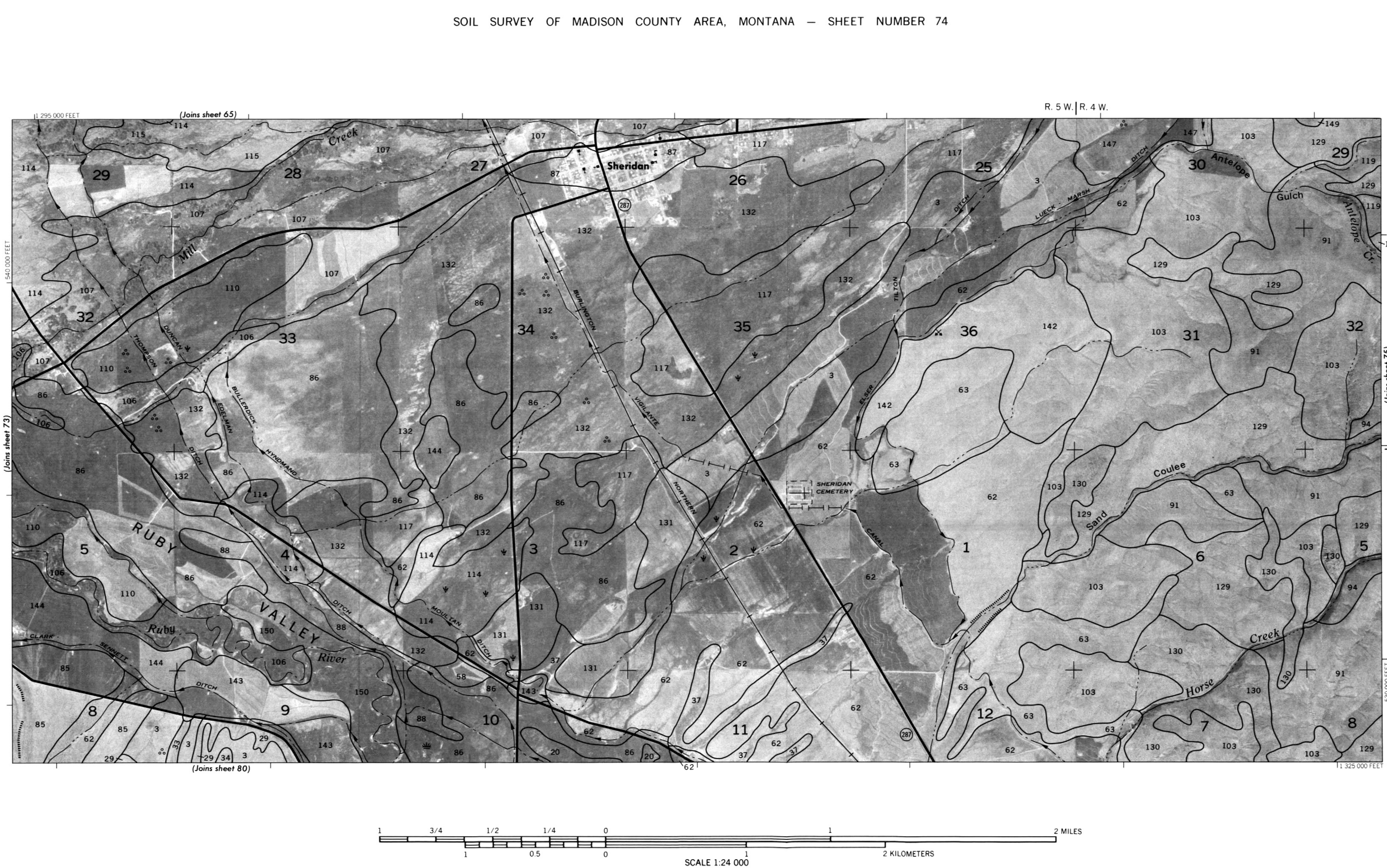
N

1 3/4 1/2 1/4 0 1 2 MILES

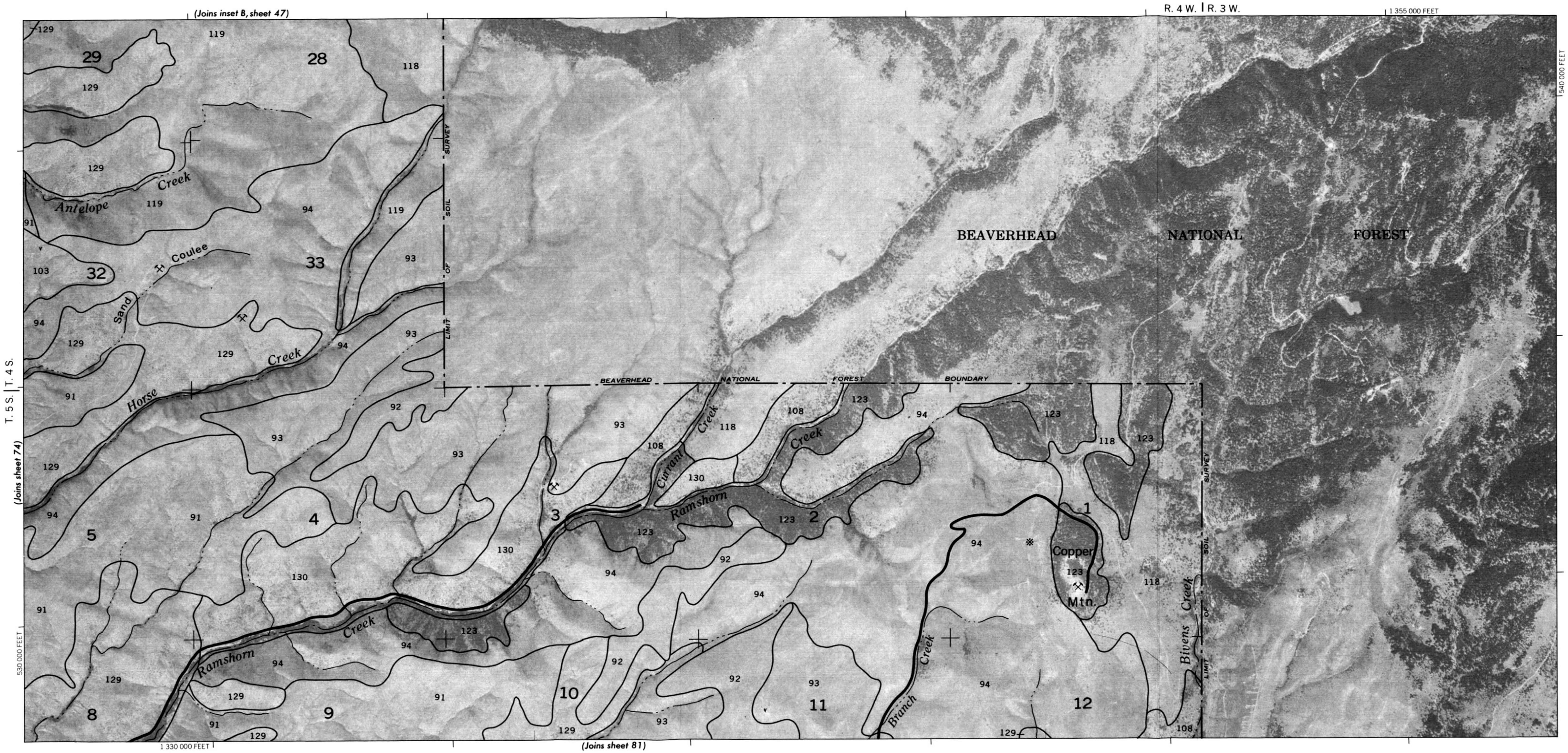
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 74



N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

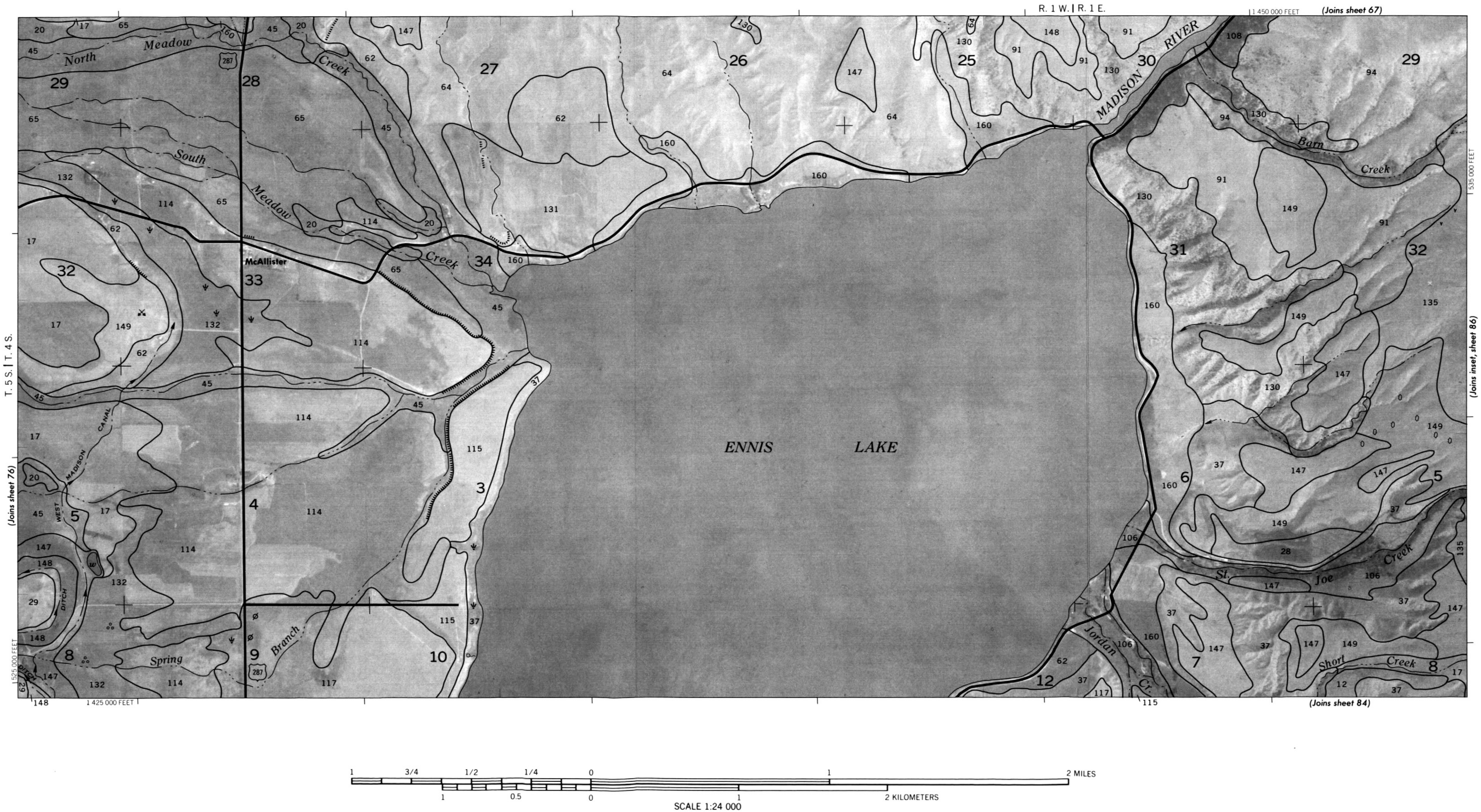
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 76

1 3/4 1/2 1/4 0 1 2 MILES

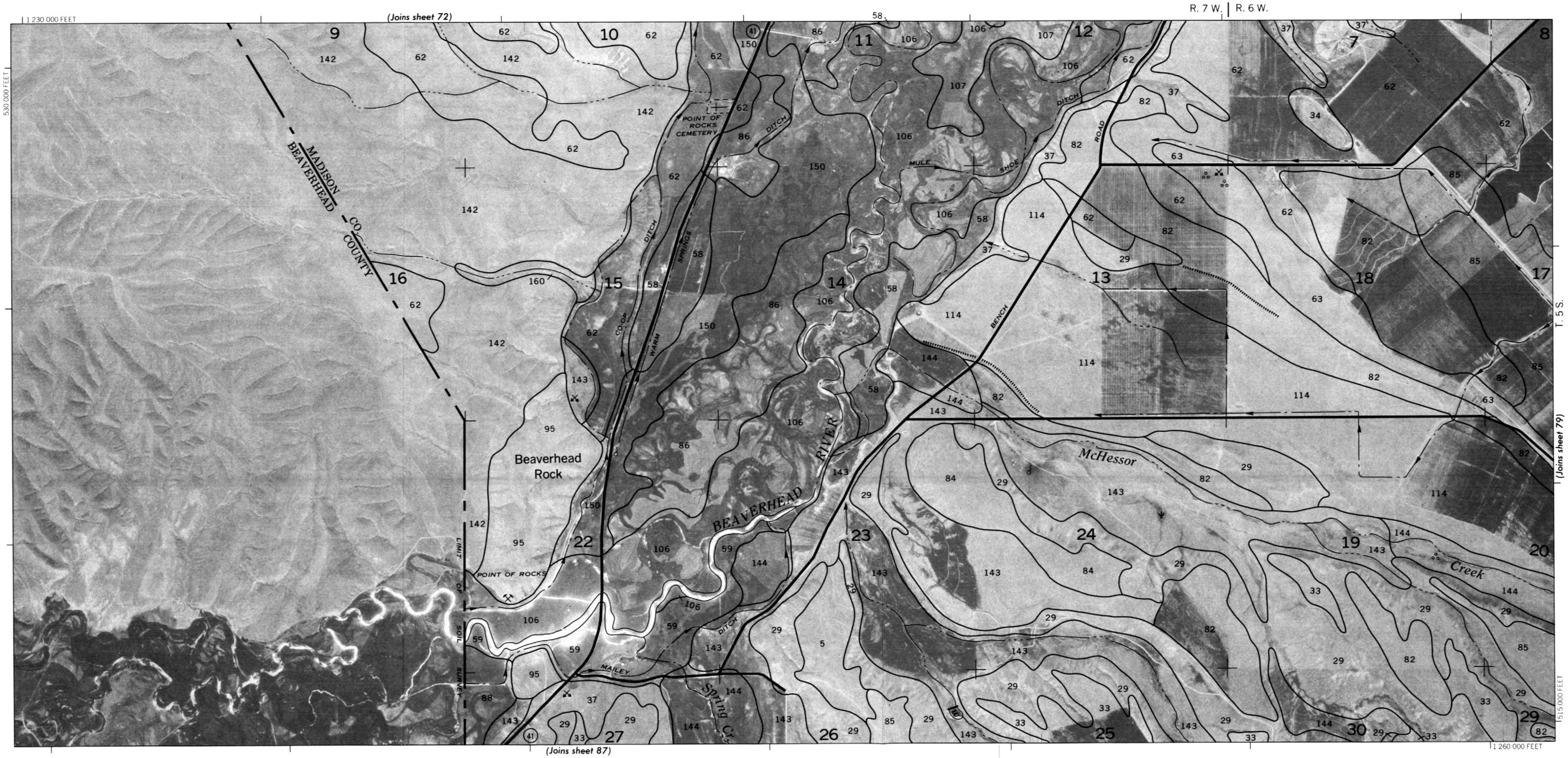
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000


N
R. 1 W. | R. 1 E.
1 450 000 FEET
(Joins sheet 67)
(Joins sheet 76)
(Joins inset, sheet 86)
(Joins sheet 84)
T. 5 S. | T. 4 S.
535 000 FEET
525 000 FEET
1 425 000 FEET
North Meadow Creek
South Meadow Creek
McAllister
MADISON RIVER
ENNIS LAKE
Barn Creek
St. Joe Creek
Short Creek
Jordan Cr.
Spring Branch
WEST MADISON CANAL
DITCH
287
SCALE 1:24 000
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 78

N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

MADISON COUNTY AREA, MONTANA NO. 79

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.
Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1975, 1976, and 1977 aerial photography.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

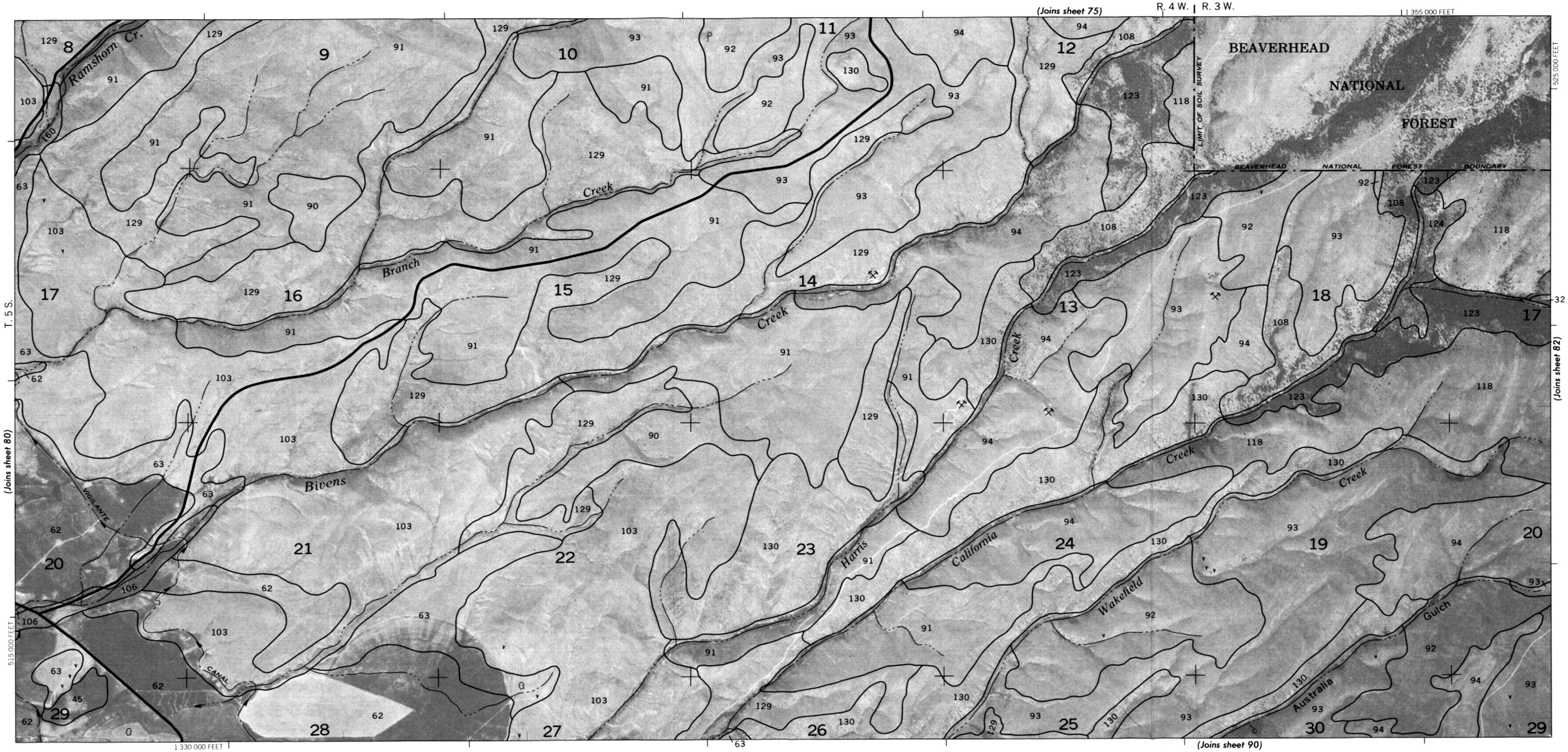
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 80

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

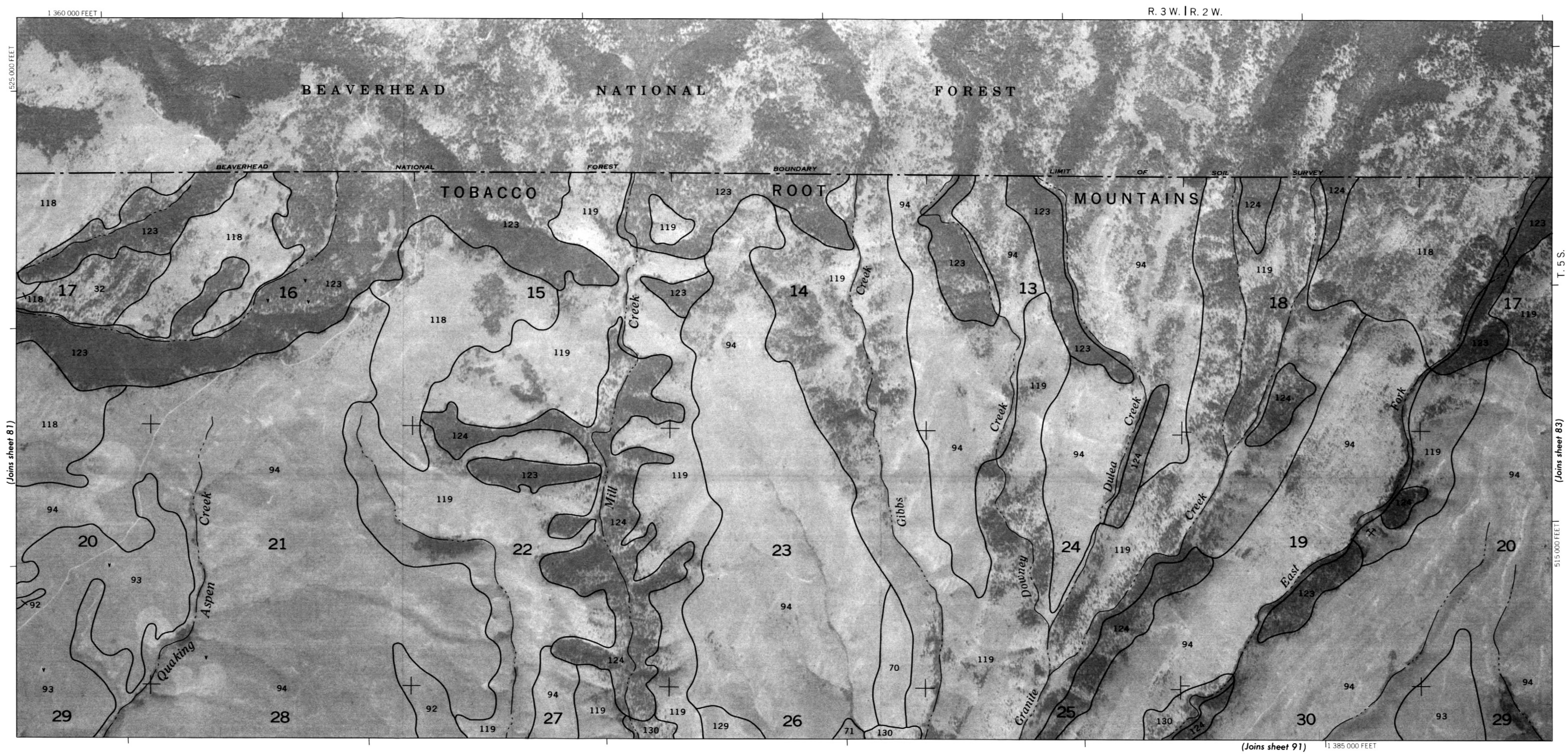


1 3/4 1/2 1/4 0 1 2 MILES

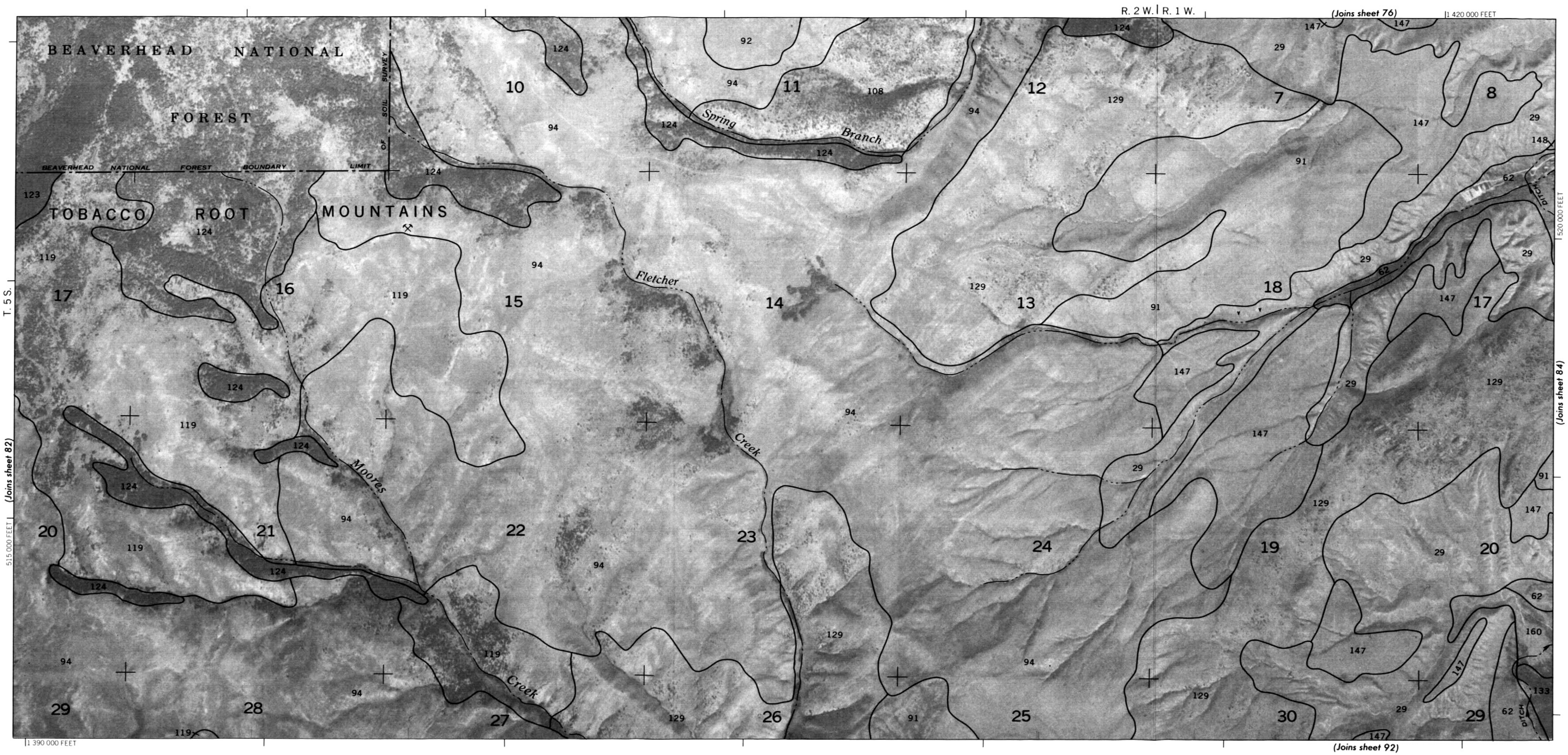
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 82



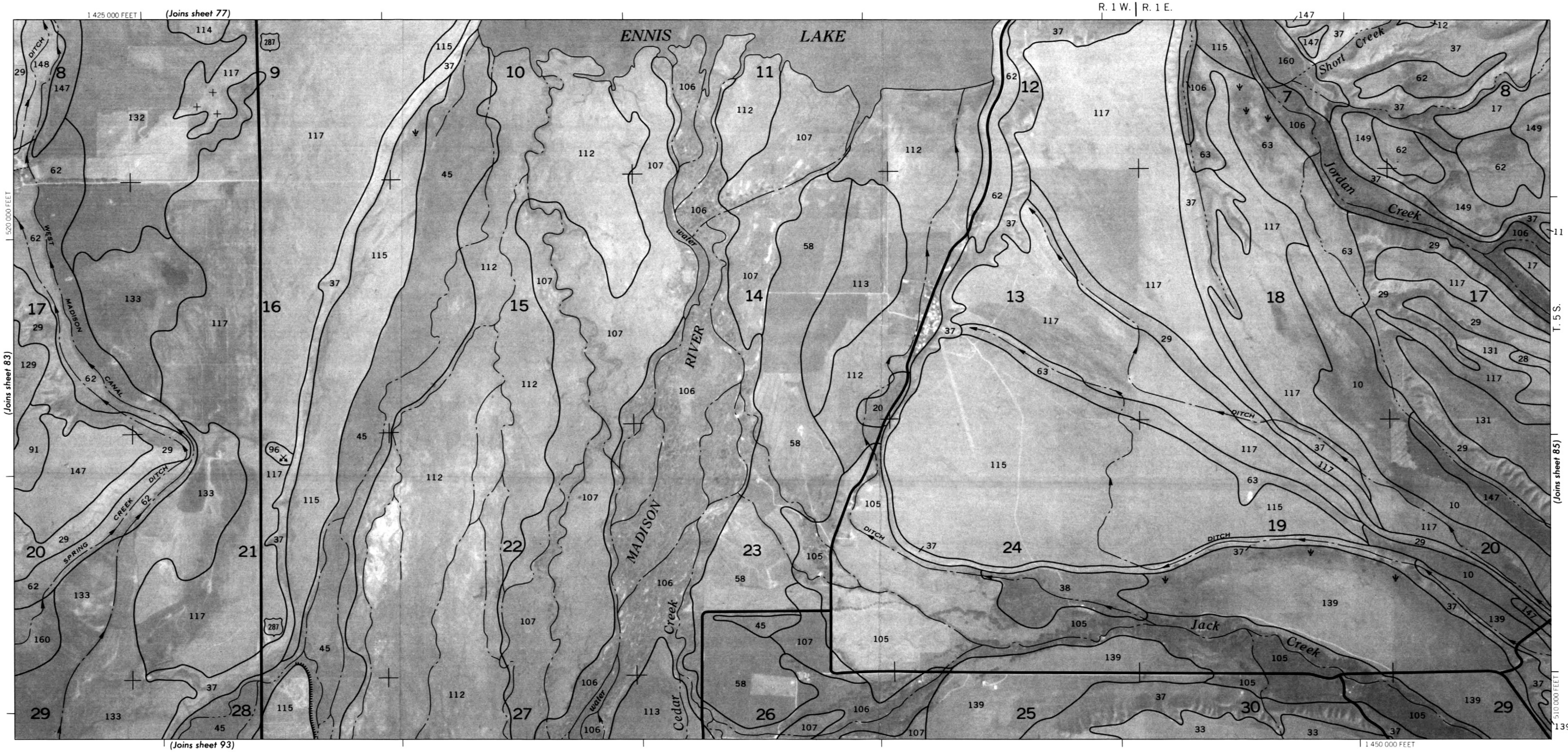
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000


N
R. 2 W. | R. 1 W.
(Joins sheet 76)
1 420 000 FEET
BEAVERHEAD NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST BOUNDARY
LIMIT OF SOIL SURVEY
TOBACCO ROOT MOUNTAINS
Spring Branch
Fletcher Creek
Moores Creek
Creek
DITCH
T. 5 S.
(Joins sheet 82)
515 000 FEET
520 000 FEET
(Joins sheet 84)
1 390 000 FEET
(Joins sheet 92)
10
11
12
7
8
17
16
15
14
13
18
20
21
22
23
24
19
29
28
27
26
25
30

1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24 000

84

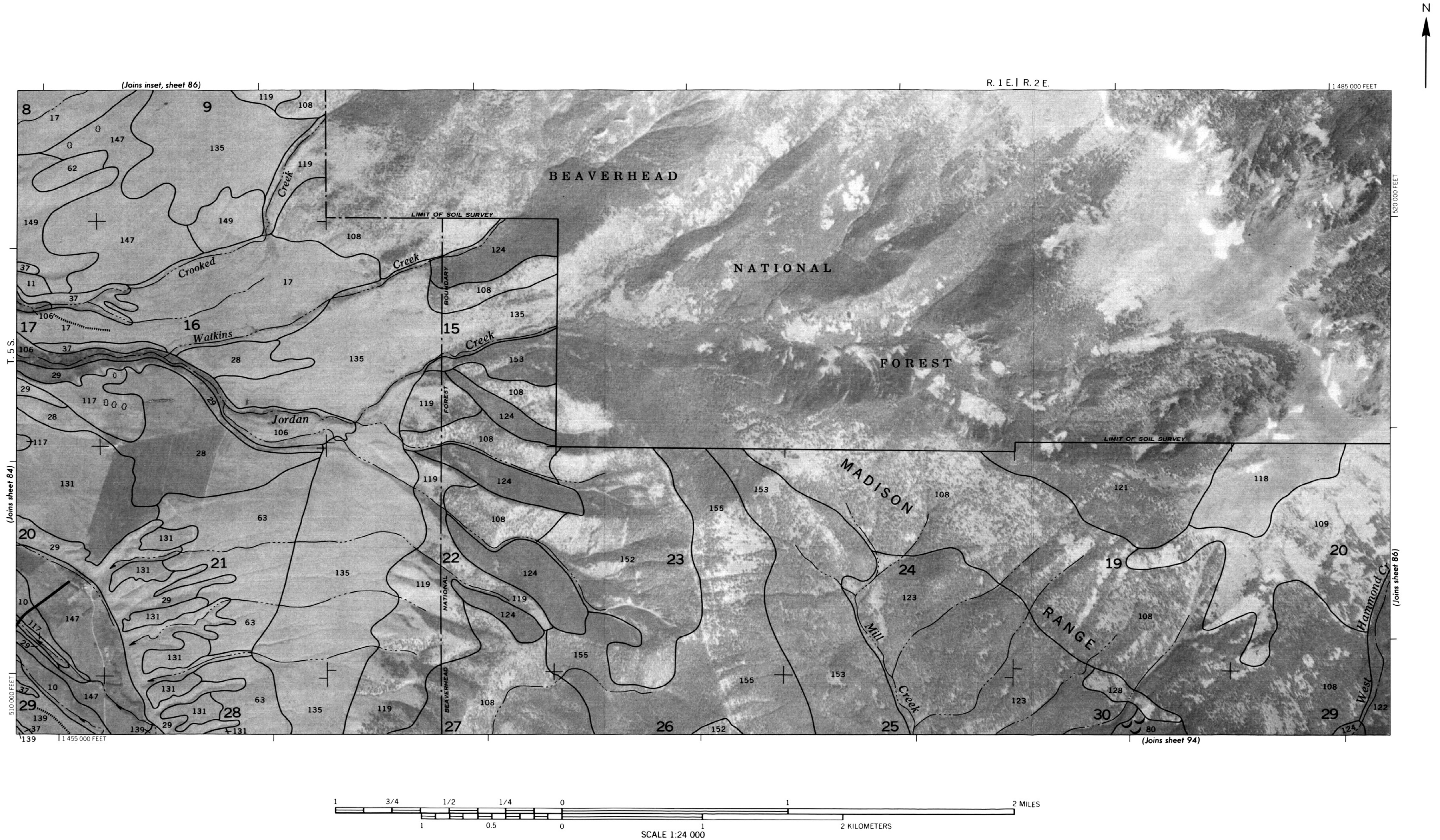
N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

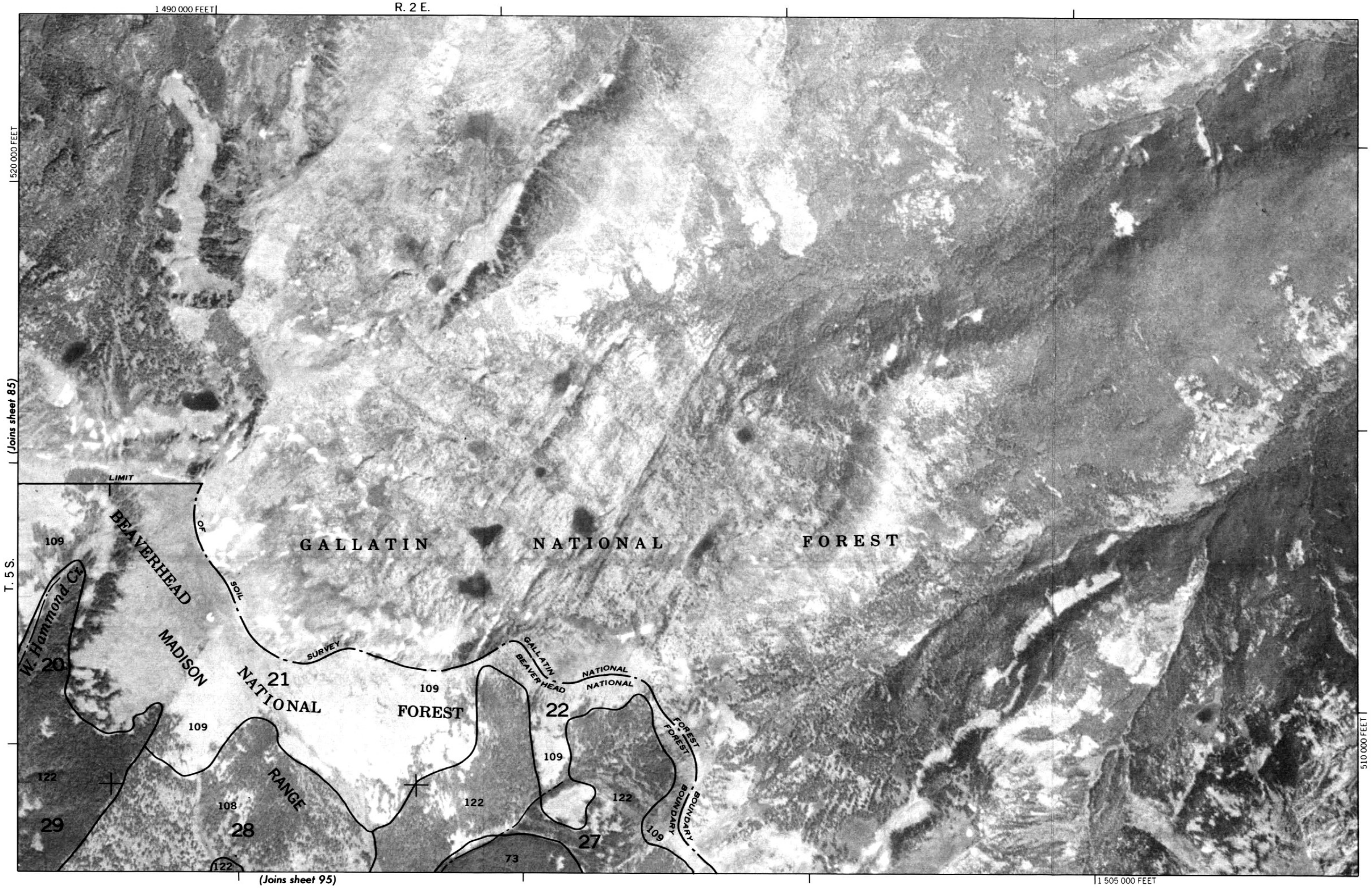
SCALE 1:24 000

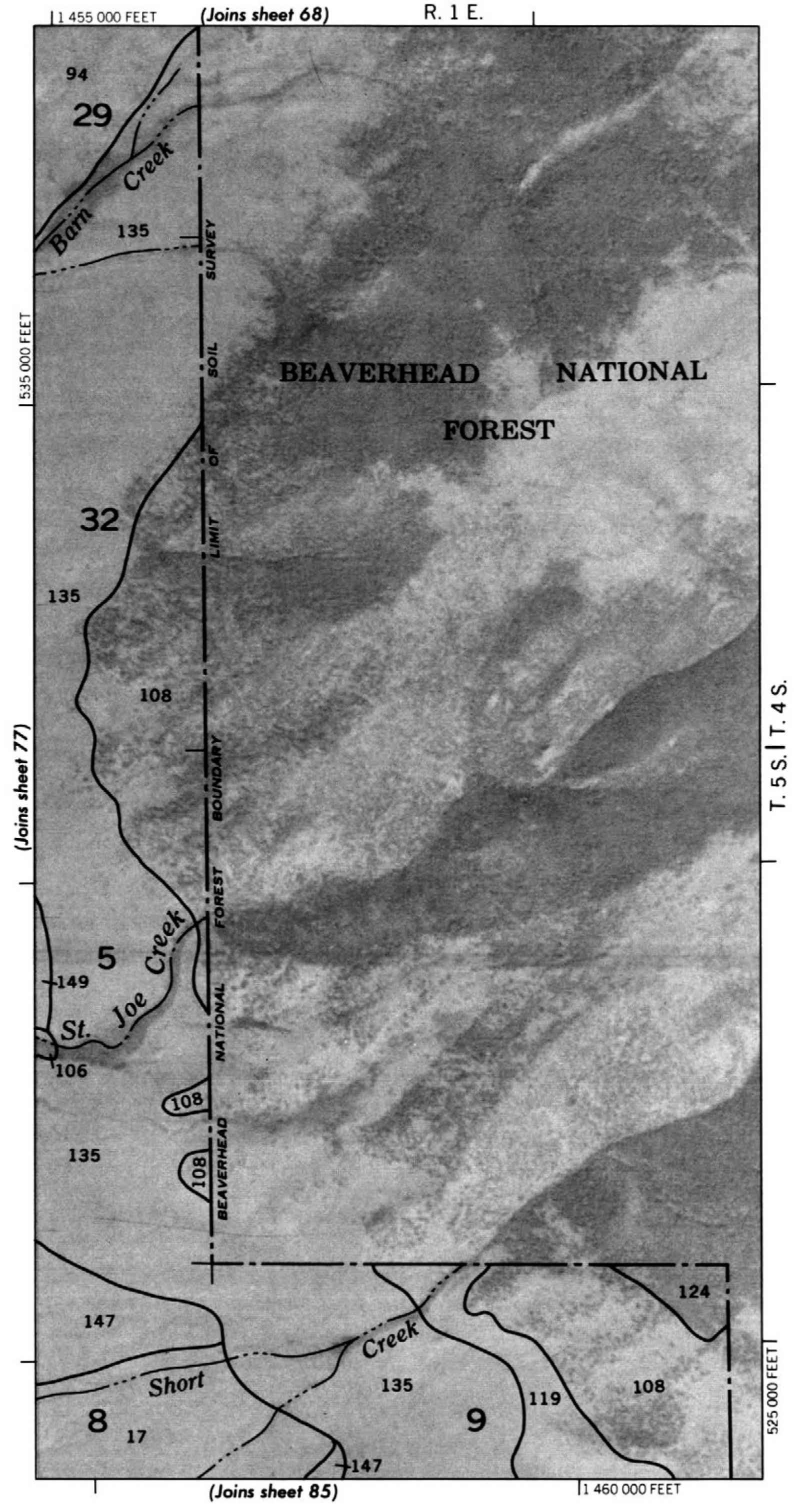

N
(Joins inset, sheet 86)
R. 1 E. | R. 2 E.
1 485 000 FEET
520 000 FEET
T. 5 S.
(Joins sheet 84)
(Joins sheet 86)
(Joins sheet 94)
510 000 FEET
1 455 000 FEET
BEAVERHEAD
NATIONAL
FOREST
MADISON
RANGE
BEAVERHEAD NATIONAL FOREST BOUNDARY
LIMIT OF SOIL SURVEY
Crooked Creek
Watkins Creek
Jordan
Mill Creek
Hammond Cr.
West
Creek
8
9
15
16
17
19
20
21
22
23
24
25
26
27
28
29
30
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24 000

86

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 86





1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

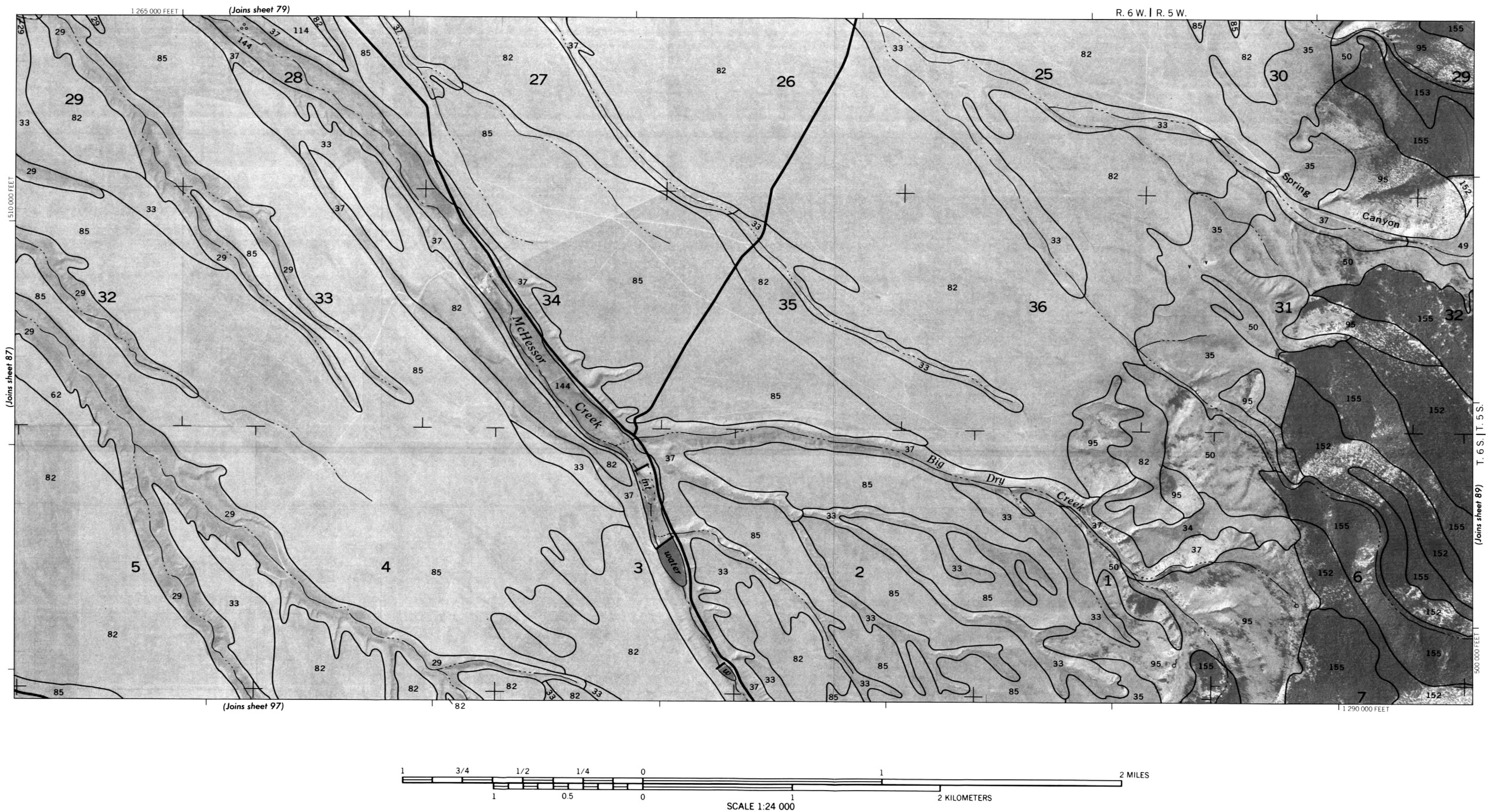
N

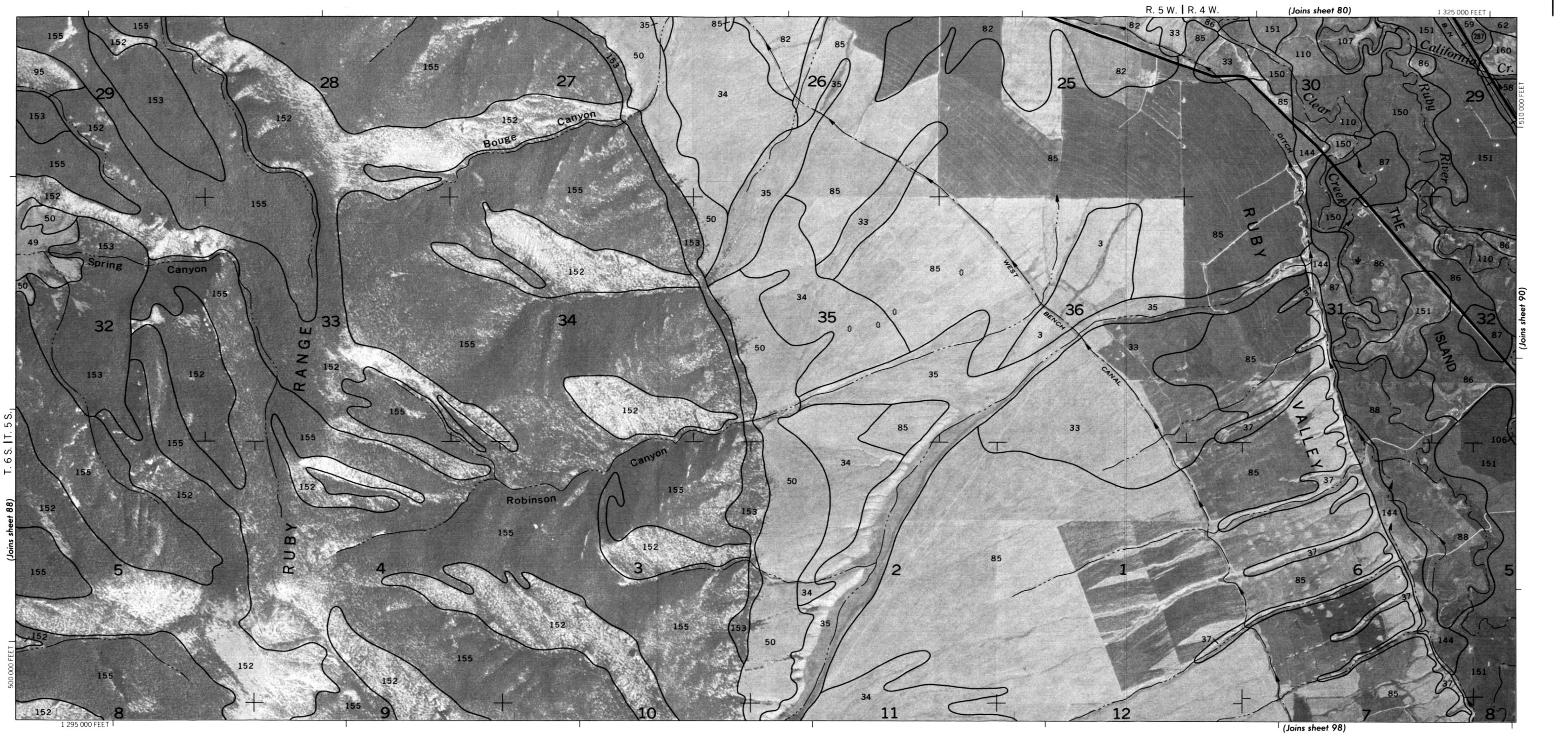
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N


(Joins sheet 79)
(Joins sheet 87)
(Joins sheet 89)
(Joins sheet 97)
1 265 000 FEET
510 000 FEET
500 000 FEET
1 290 000 FEET
R. 6 W. | R. 5 W.
T. 6 S. | T. 5 S.
McHessor Creek
Big Dry Creek
Spring Canyon
water
int
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000



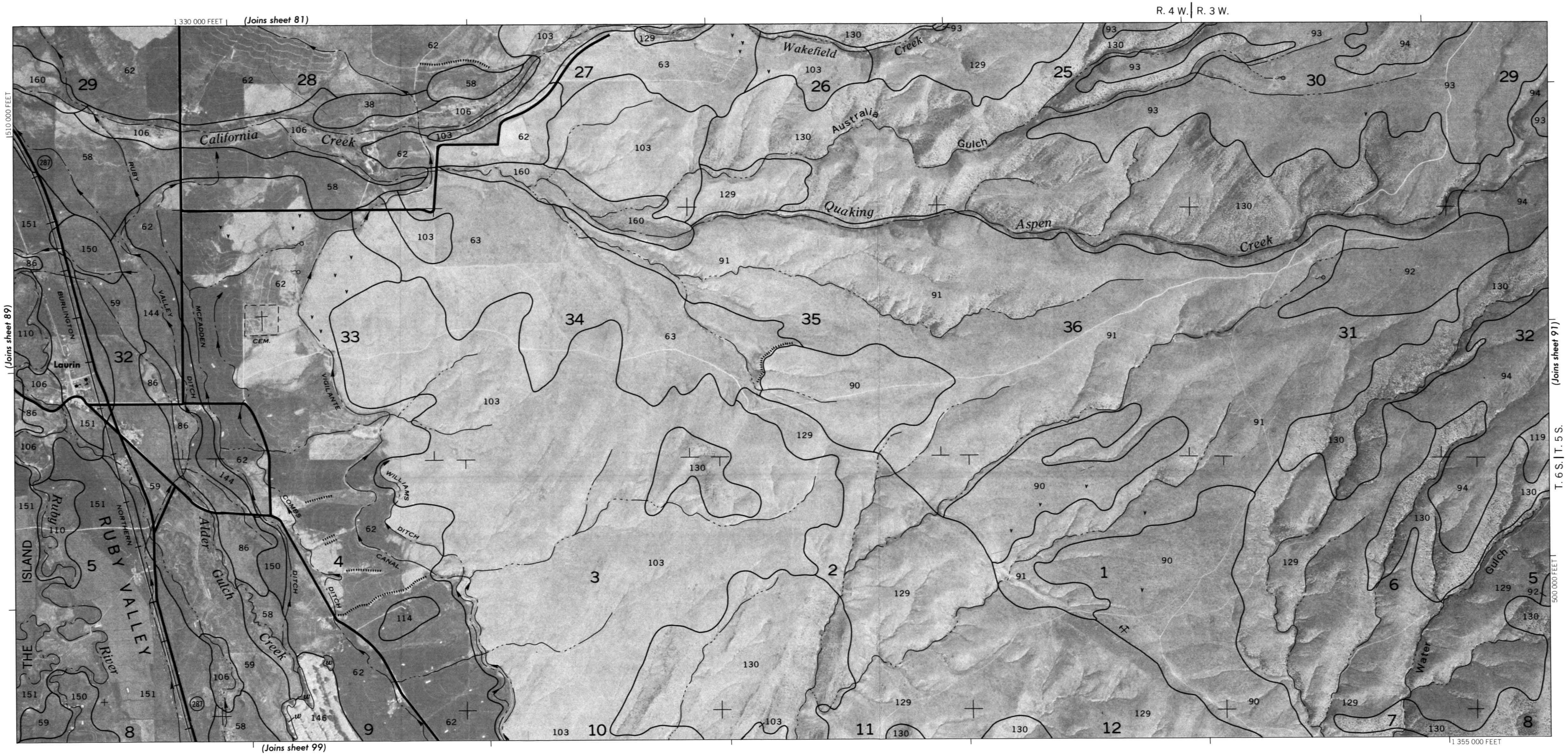
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 90



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1975, 1976, and 1977 aerial photography.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

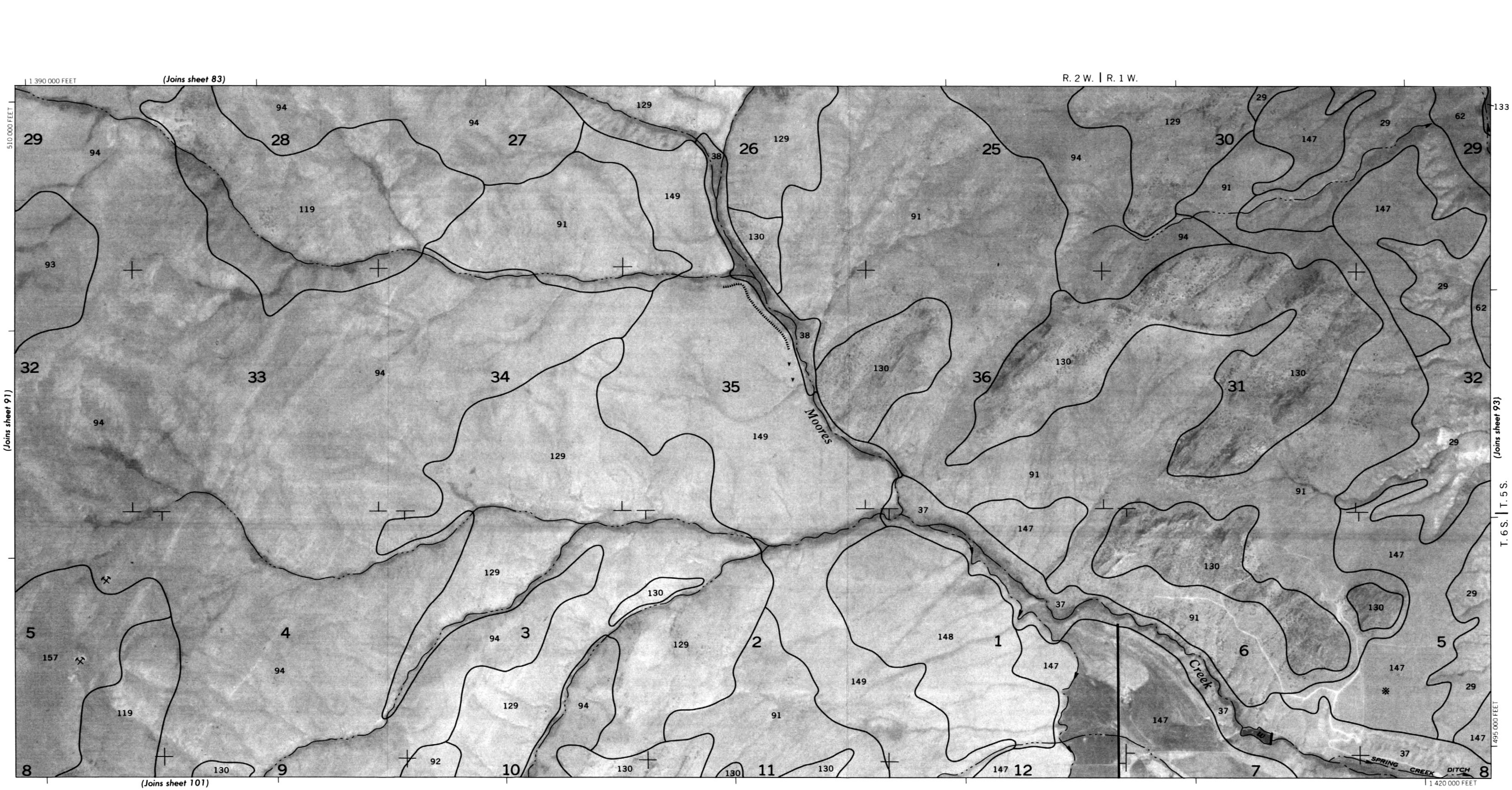
N

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

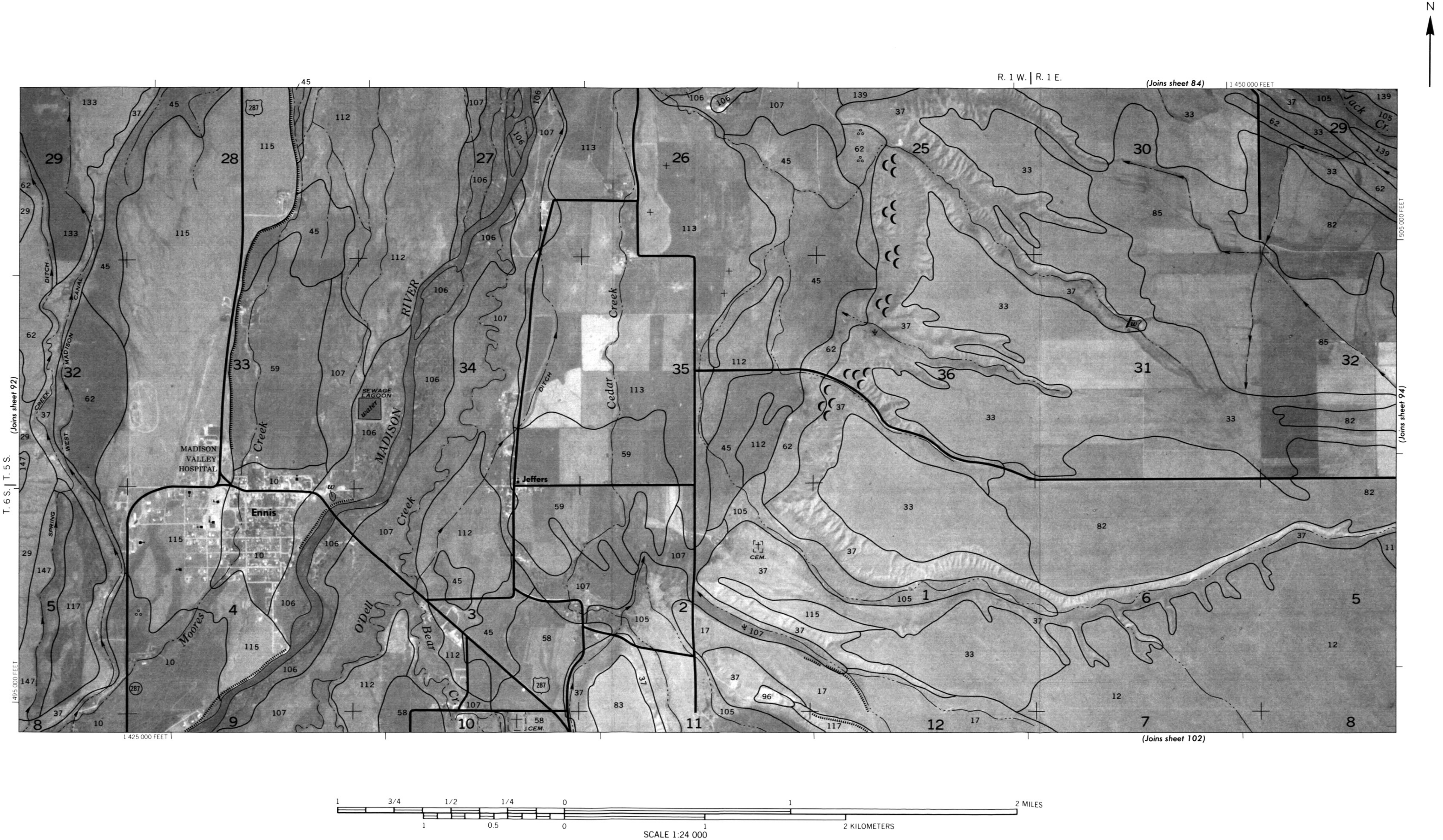
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 92



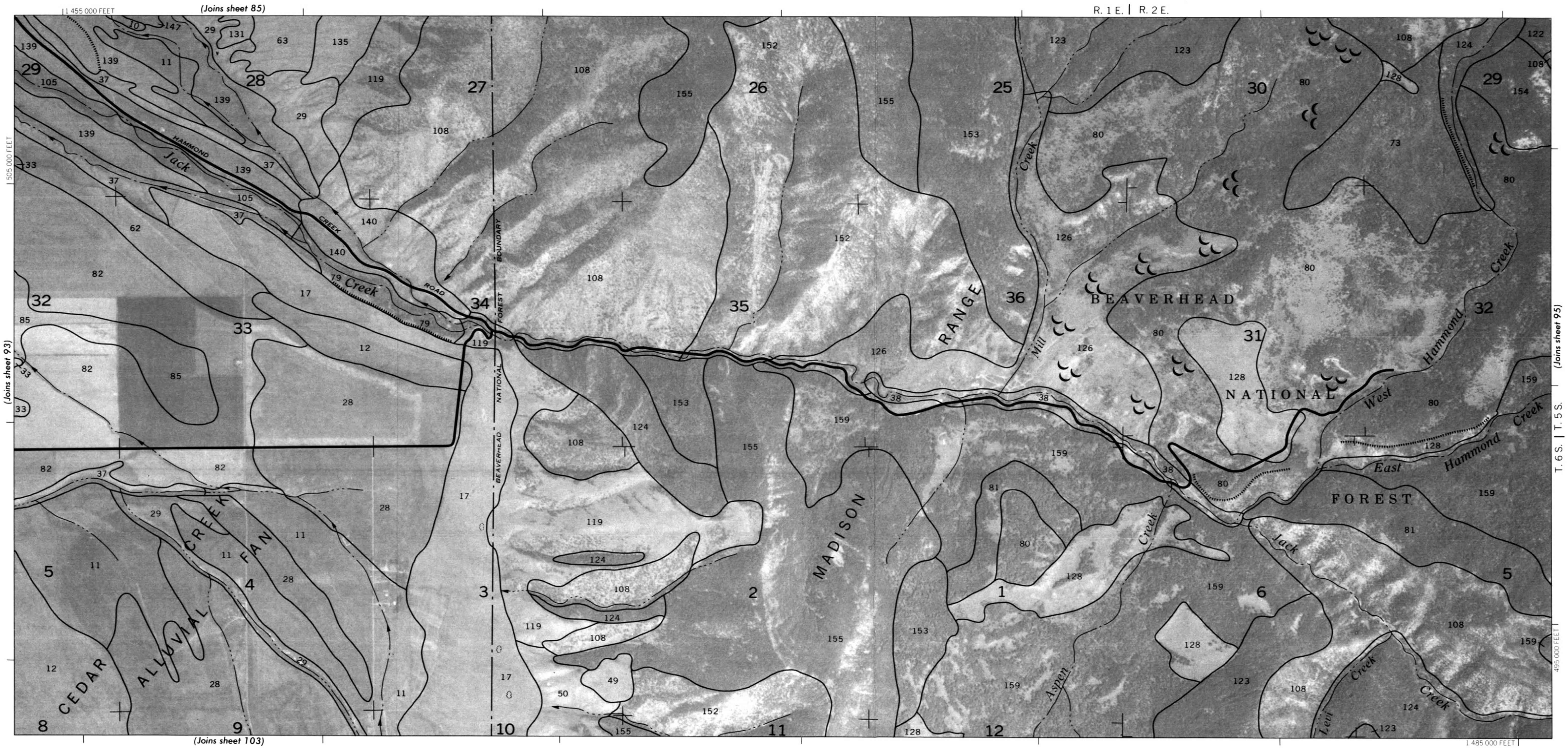
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000


N
R. 1 W. | R. 1 E.
(Joins sheet 84)
(Joins sheet 92)
(Joins sheet 94)
(Joins sheet 102)
T. 6 S. | T. 5 S.
1 450 000 FEET
1 425 000 FEET
495 000 FEET
505 000 FEET
Ennis
Jeffers
MADISON VALLEY HOSPITAL
SEWAGE LAGOON
MADISON RIVER
Cedar Creek
O'Dell Creek
Moores Creek
Bear Cr.
Jack Cr.
WEST MADISON CANAL
SPRING CREEK
DITCH
CEM.
287
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

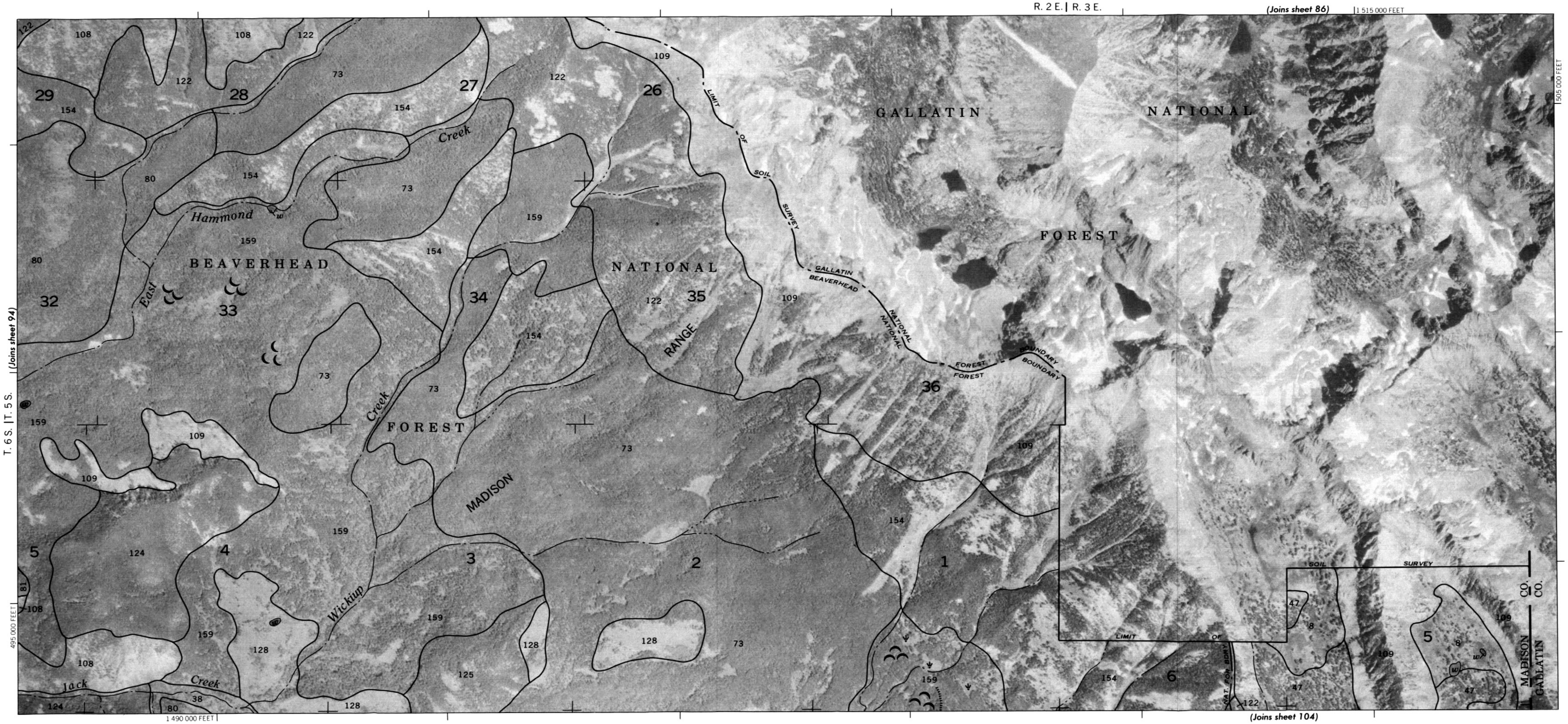
N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

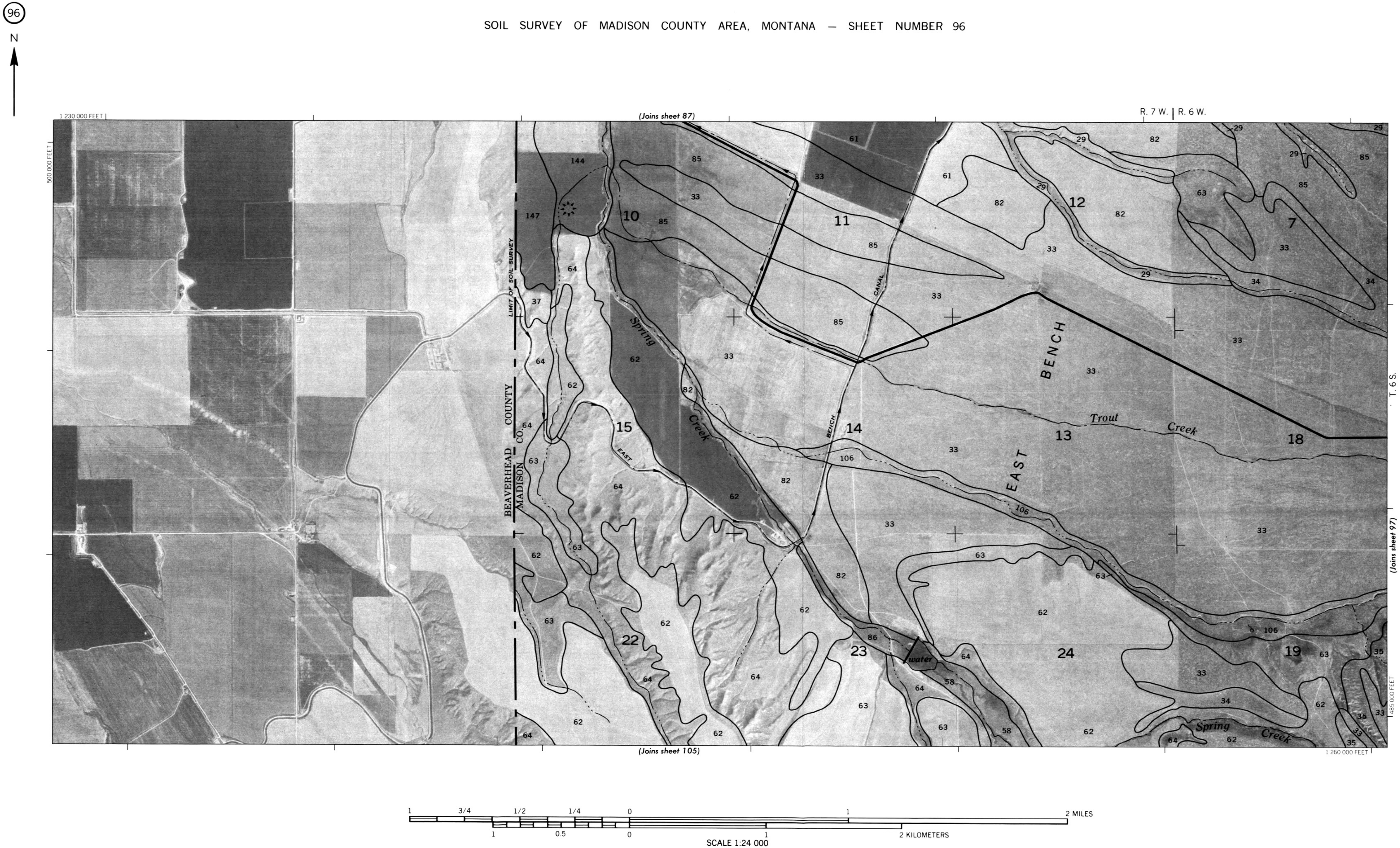


1 3/4 1/2 1/4 0 1 2 MILES

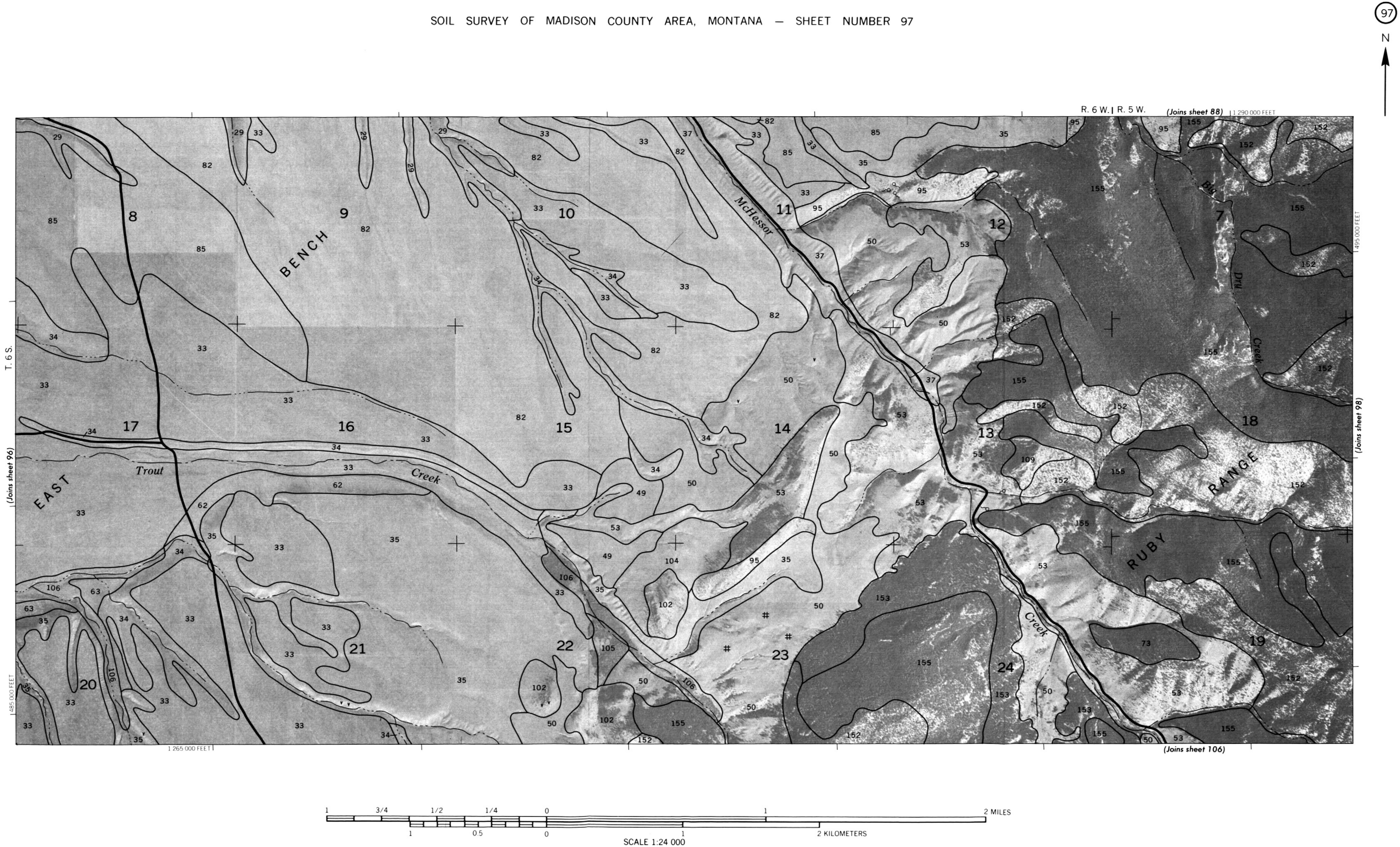
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 96



SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 97



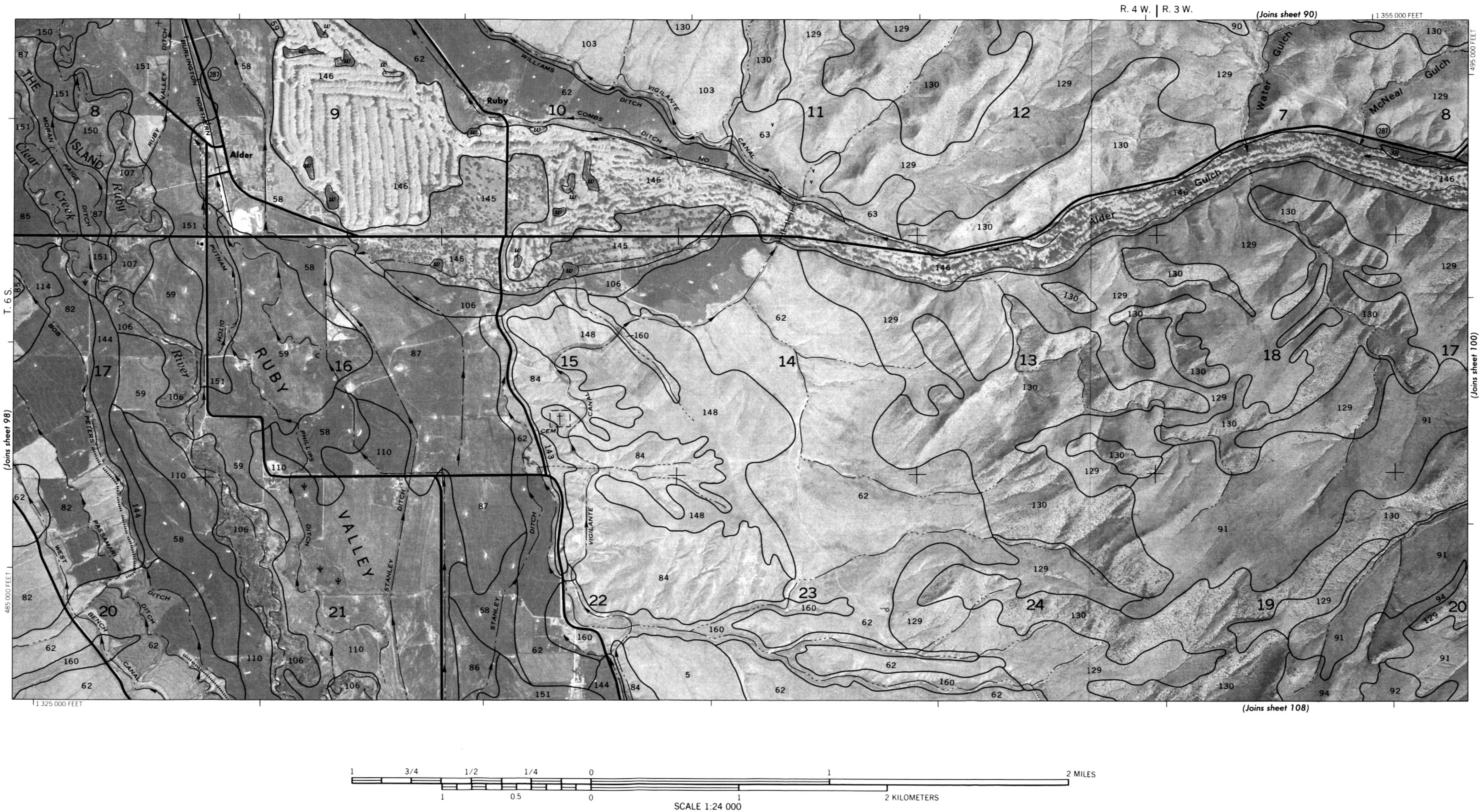
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 98

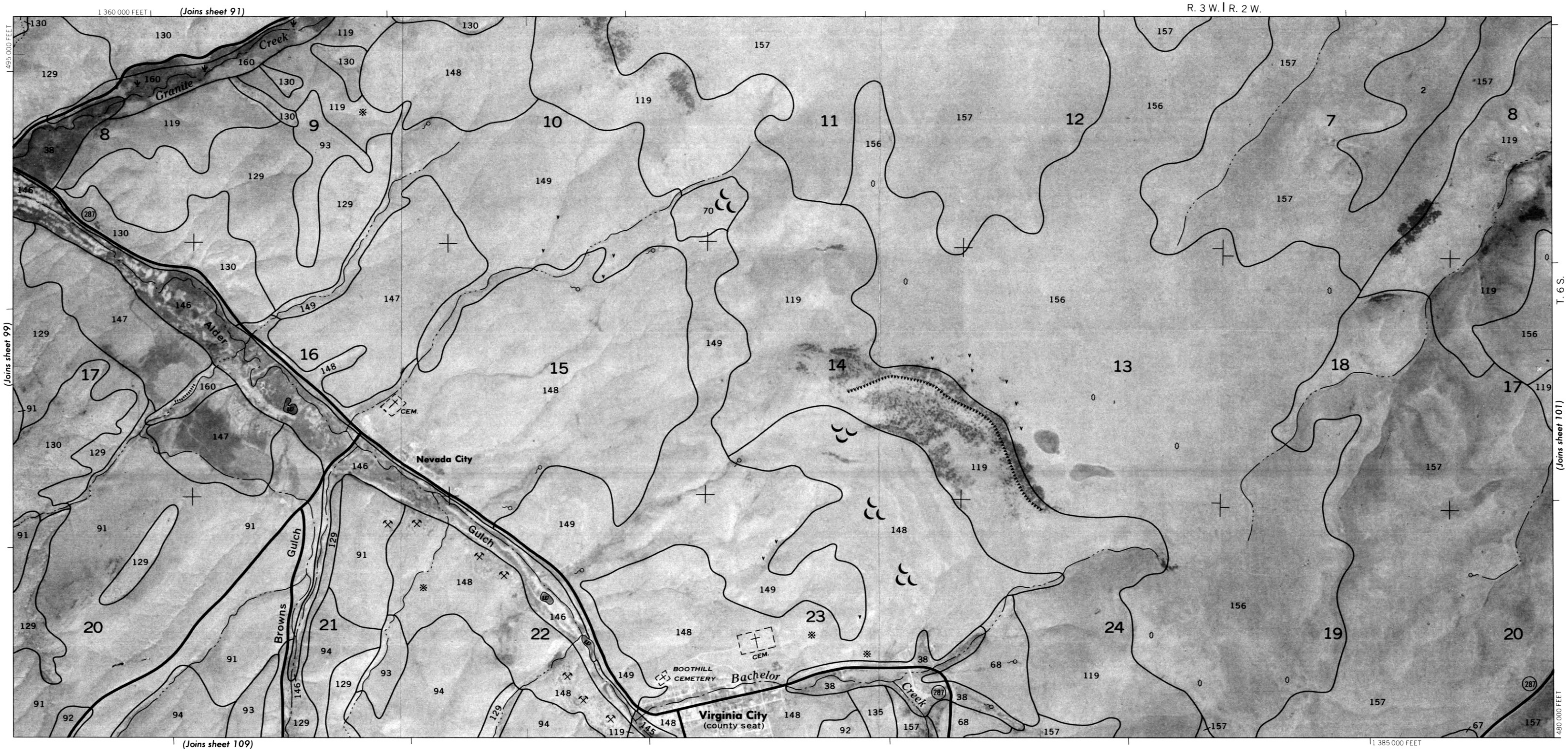
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

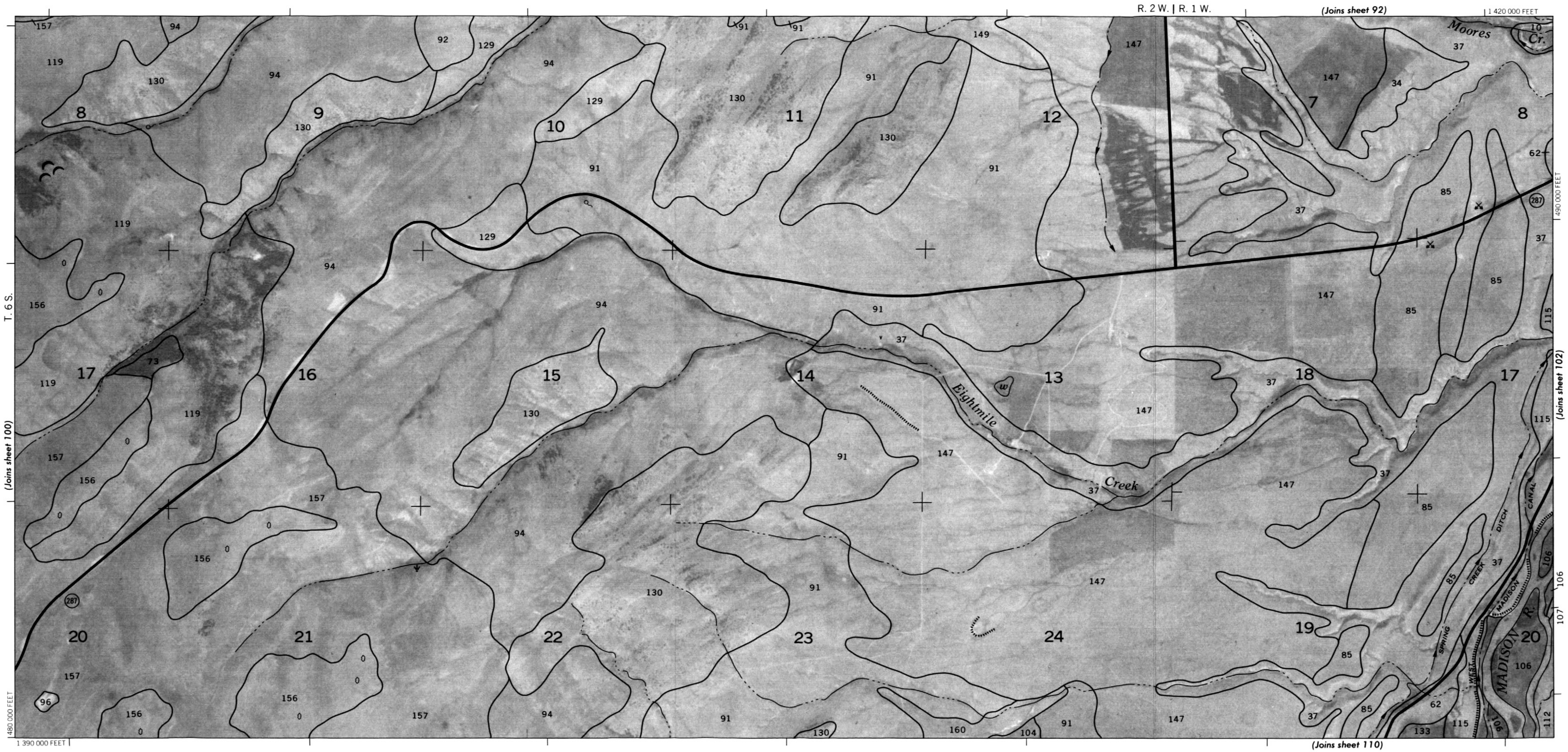

R. 4 W. | R. 3 W.
(Joins sheet 90)
1 355 000 FEET
495 000 FEET
(Joins sheet 100)
(Joins sheet 108)
1 325 000 FEET
485 000 FEET
(Joins sheet 98)
T. 6 S.
Ruby
Alder
THE ISLAND
Clear Creek
Ruby River
RUBY VALLEY
Alder Gulch
Water Gulch
McNeal Gulch
WILLIAMS DITCH
VIGILANTE DITCH
COMBS DITCH
CANAL NO 2
BURLINGTON NORTHERN
RUBY VALLEY DITCH
MORAN DITCH
PAIGE DITCH
PUTNAM DITCH
PHILLIPS DITCH
PETERS DITCH
BOB
PASSAMARI DITCH
WEST BENCH CANAL
STANLEY DITCH
VIGILANTE CANAL
CEM
287
38
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000



1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

101

N

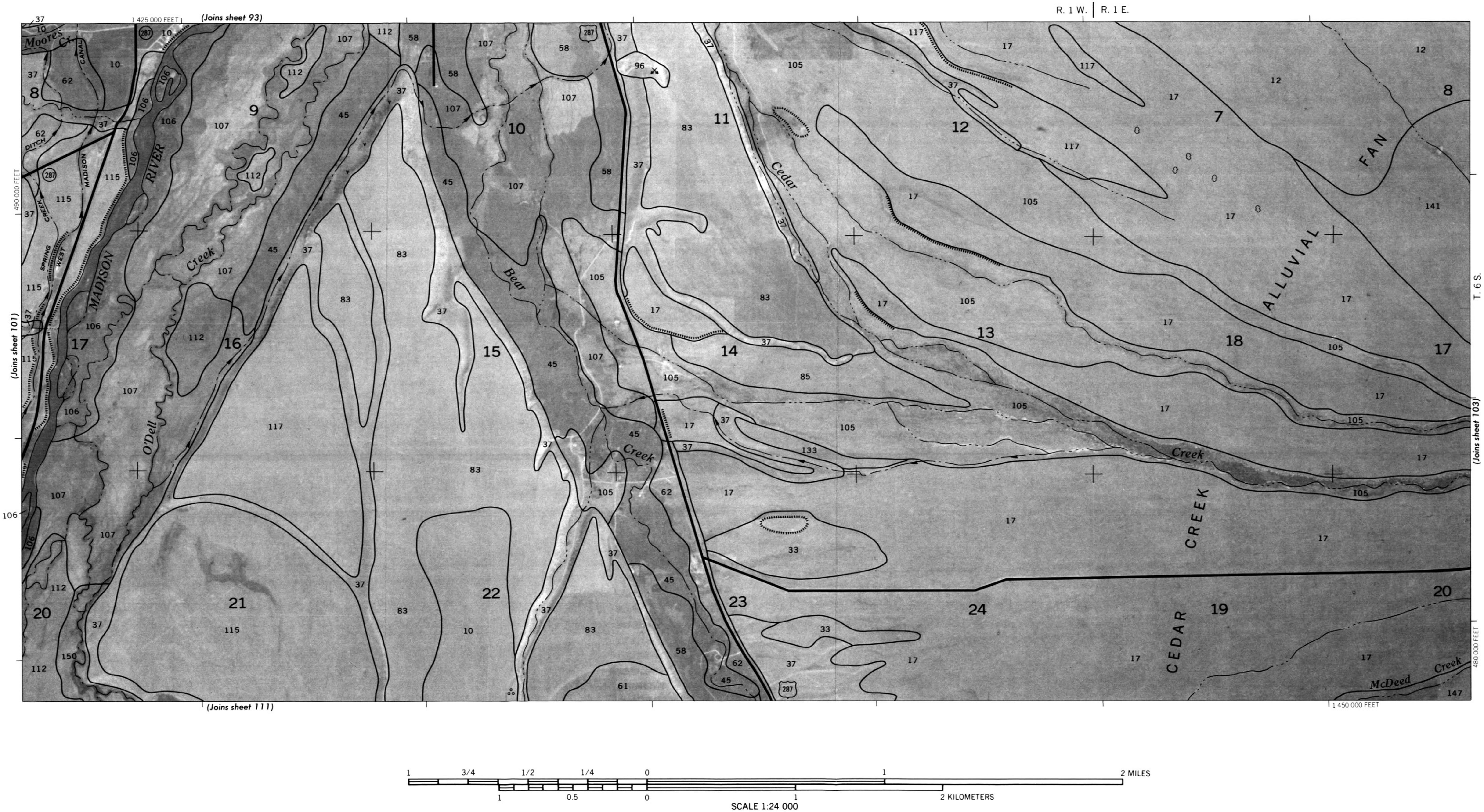


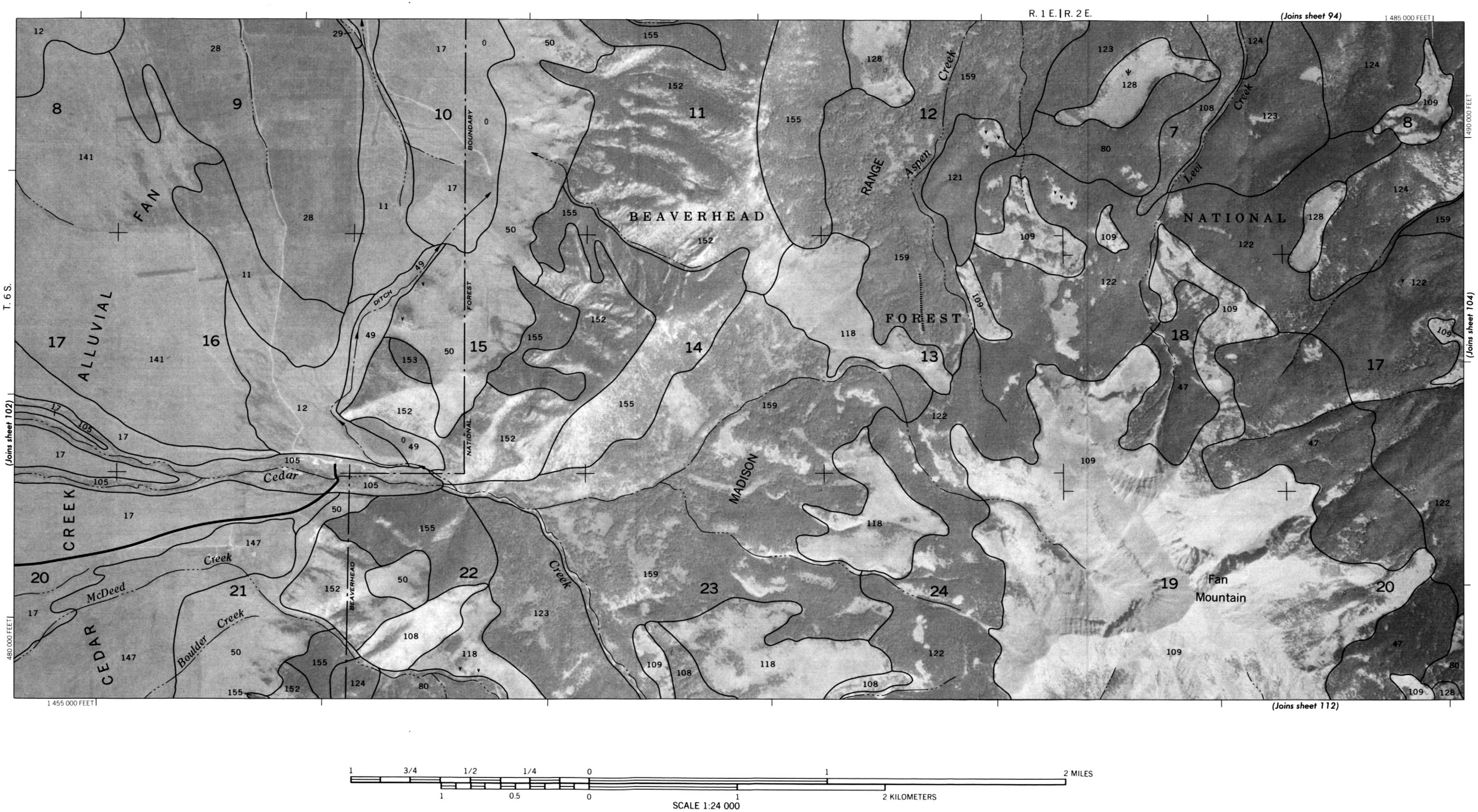
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

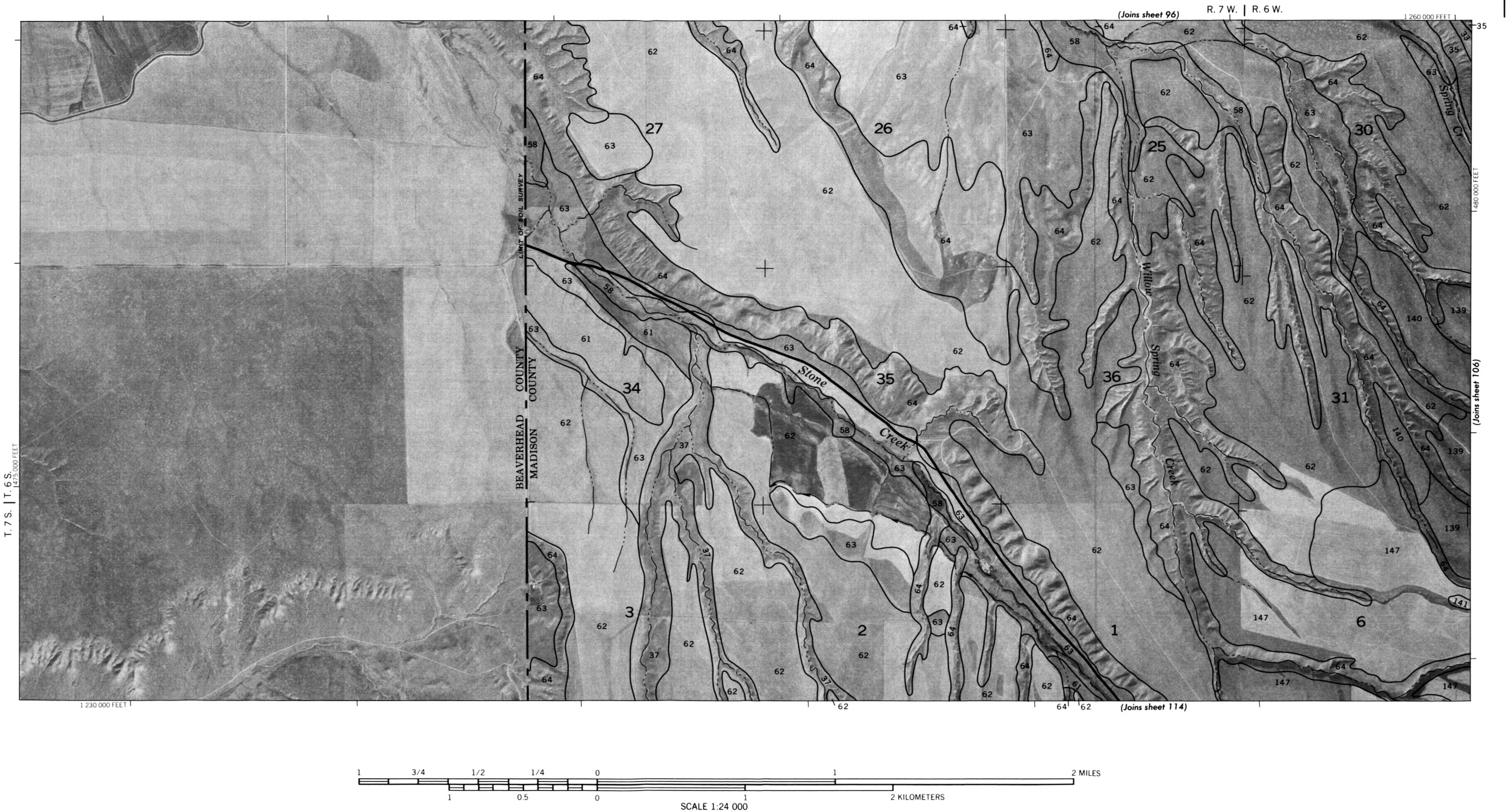
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 102

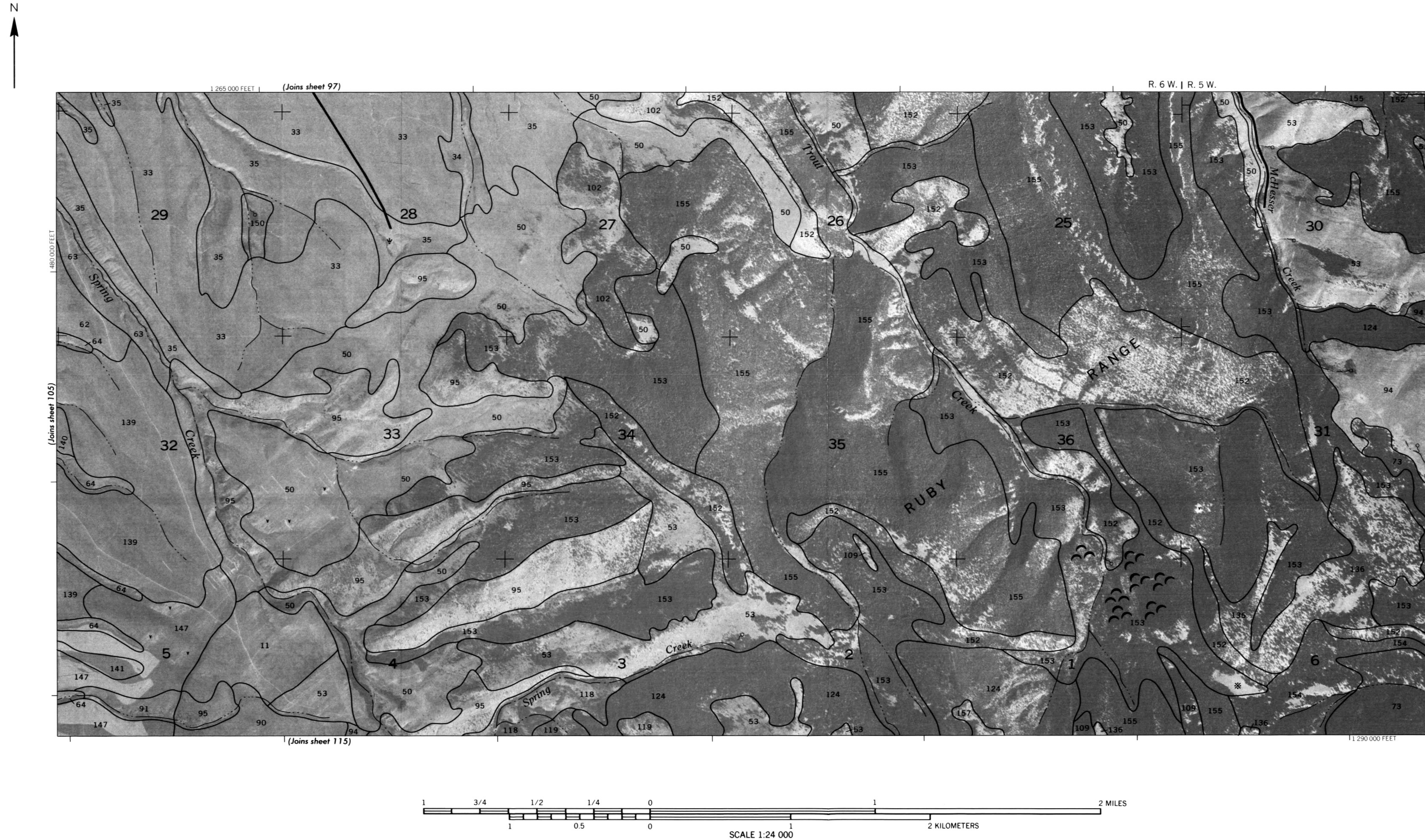



N
R. 1 E. | R. 2 E.
(Joins sheet 94)
1 485 000 FEET
490 000 FEET
T. 6 S.
(Joins sheet 102)
(Joins sheet 104)
(Joins sheet 112)
1 455 000 FEET
480 000 FEET
ALLUVIAL FAN
CEDAR CREEK
Cedar
McDeed Creek
Boulder Creek
Creek
DITCH
NATIONAL FOREST BOUNDARY
BEAVERHEAD NATIONAL FOREST
BEAVERHEAD
MADISON RANGE
Aspen Creek
Levi Creek
Fan Mountain
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 104


105
N
(Joins sheet 96)
R. 7 W. | R. 6 W.
1 260 000 FEET
480 000 FEET
(Joins sheet 106)
(Joins sheet 114)
1 230 000 FEET
475 000 FEET
T. 7 S. | T. 6 S.
LIMIT OF SOIL SURVEY
BEAVERHEAD COUNTY
MADISON COUNTY
Stone Creek
Willow Spring Creek
Spring Cr.
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 106



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 108

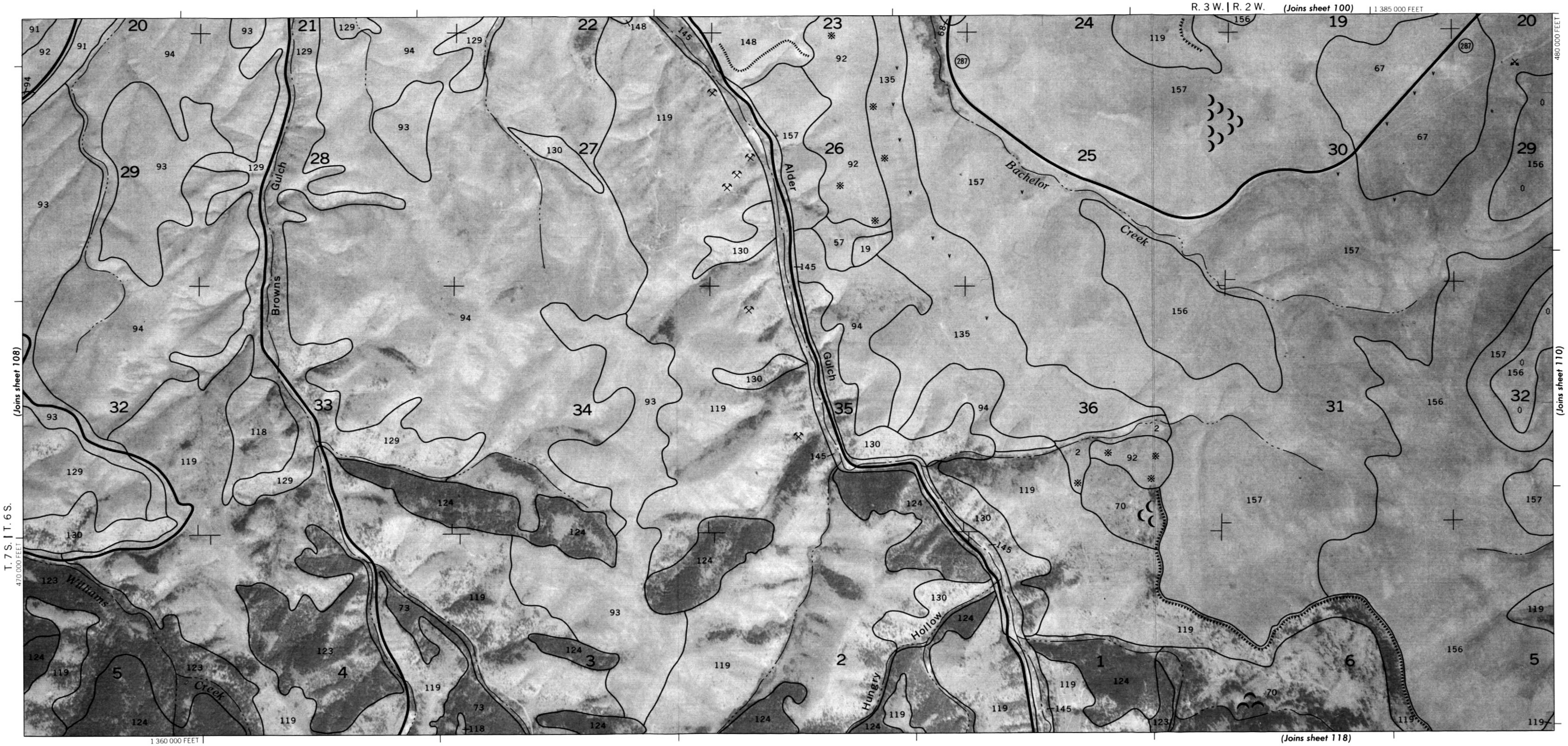
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

109

N

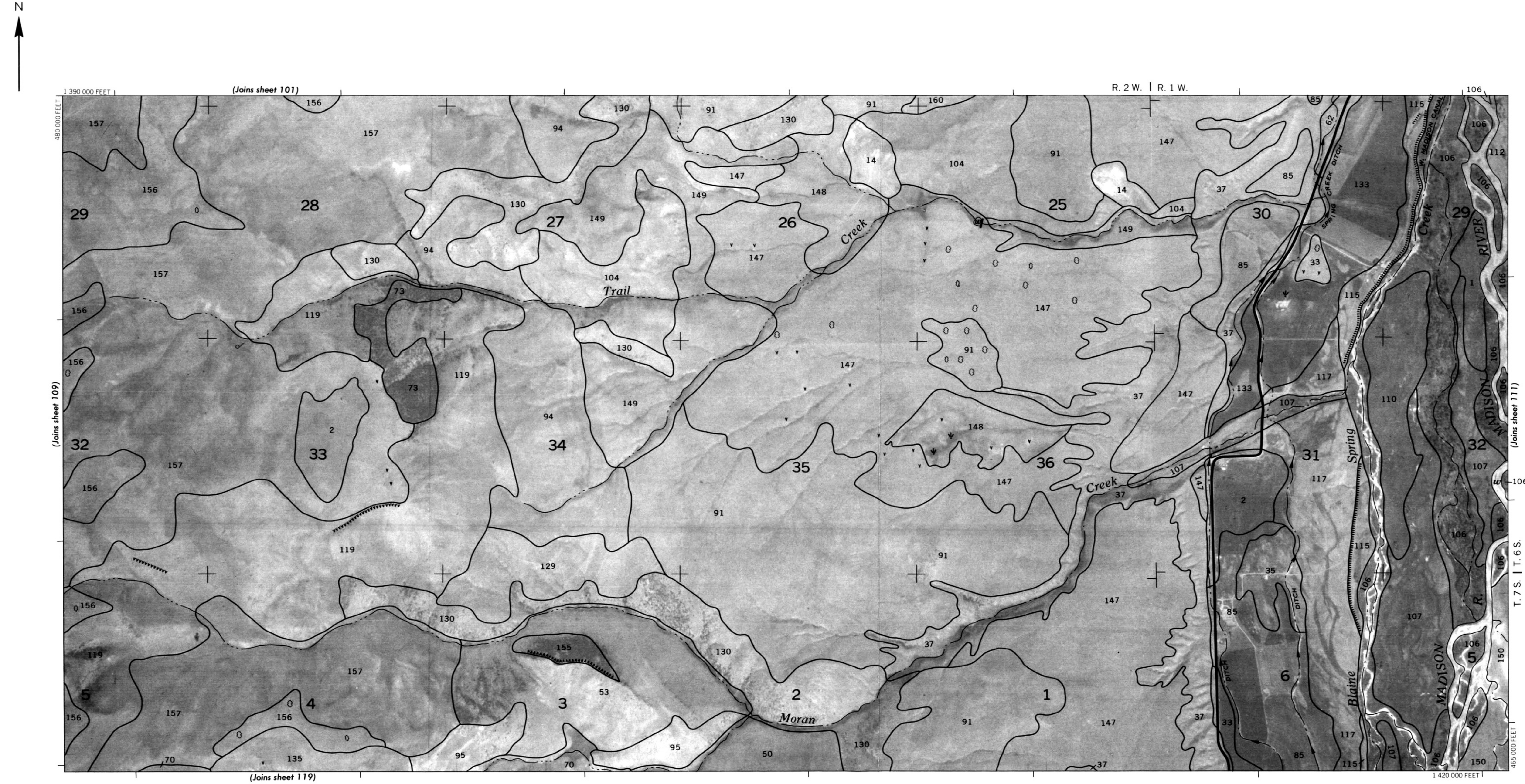


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 110



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

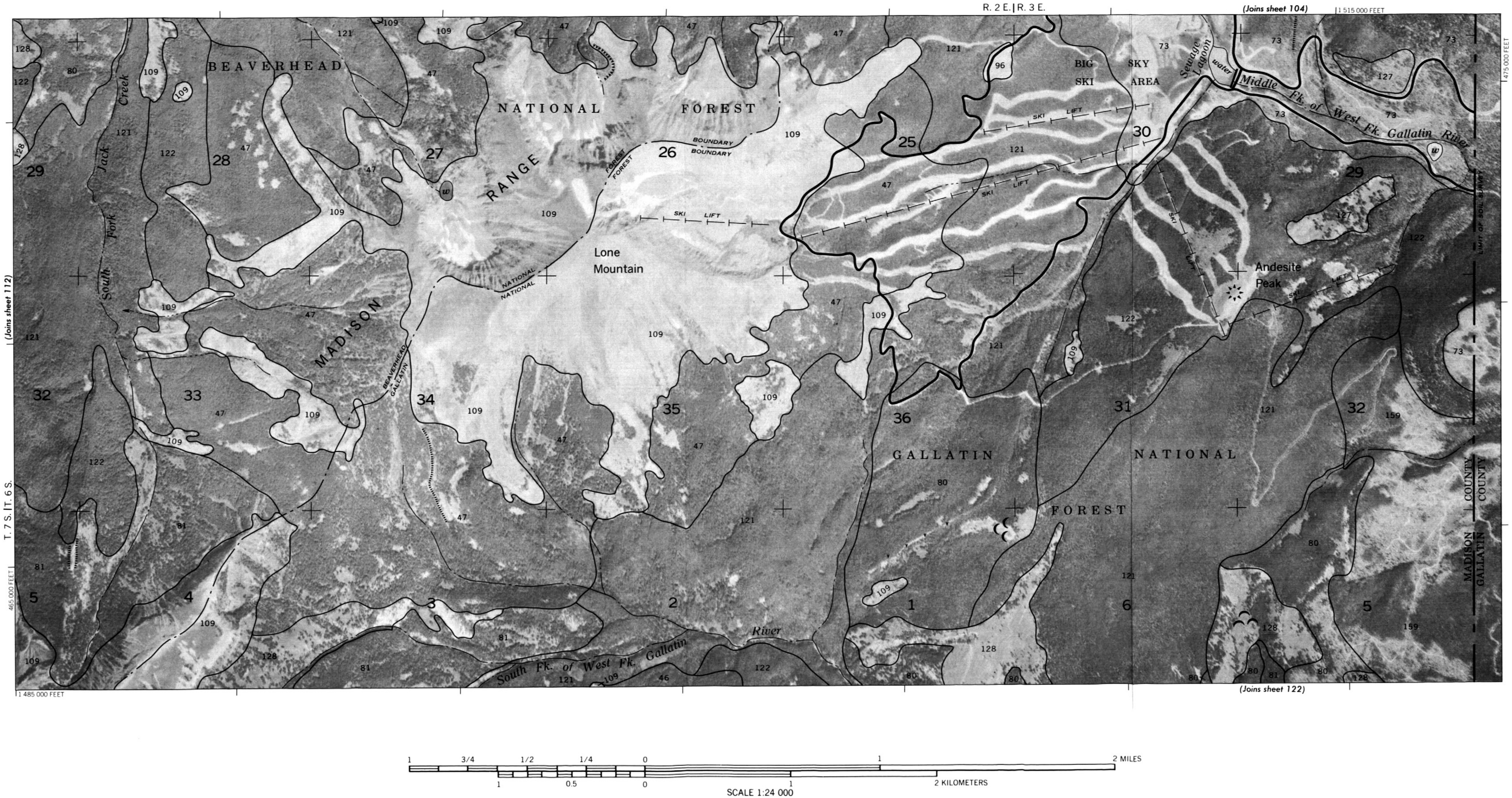
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 111

1 3/4 1/2 1/4 0 1 2 MILES

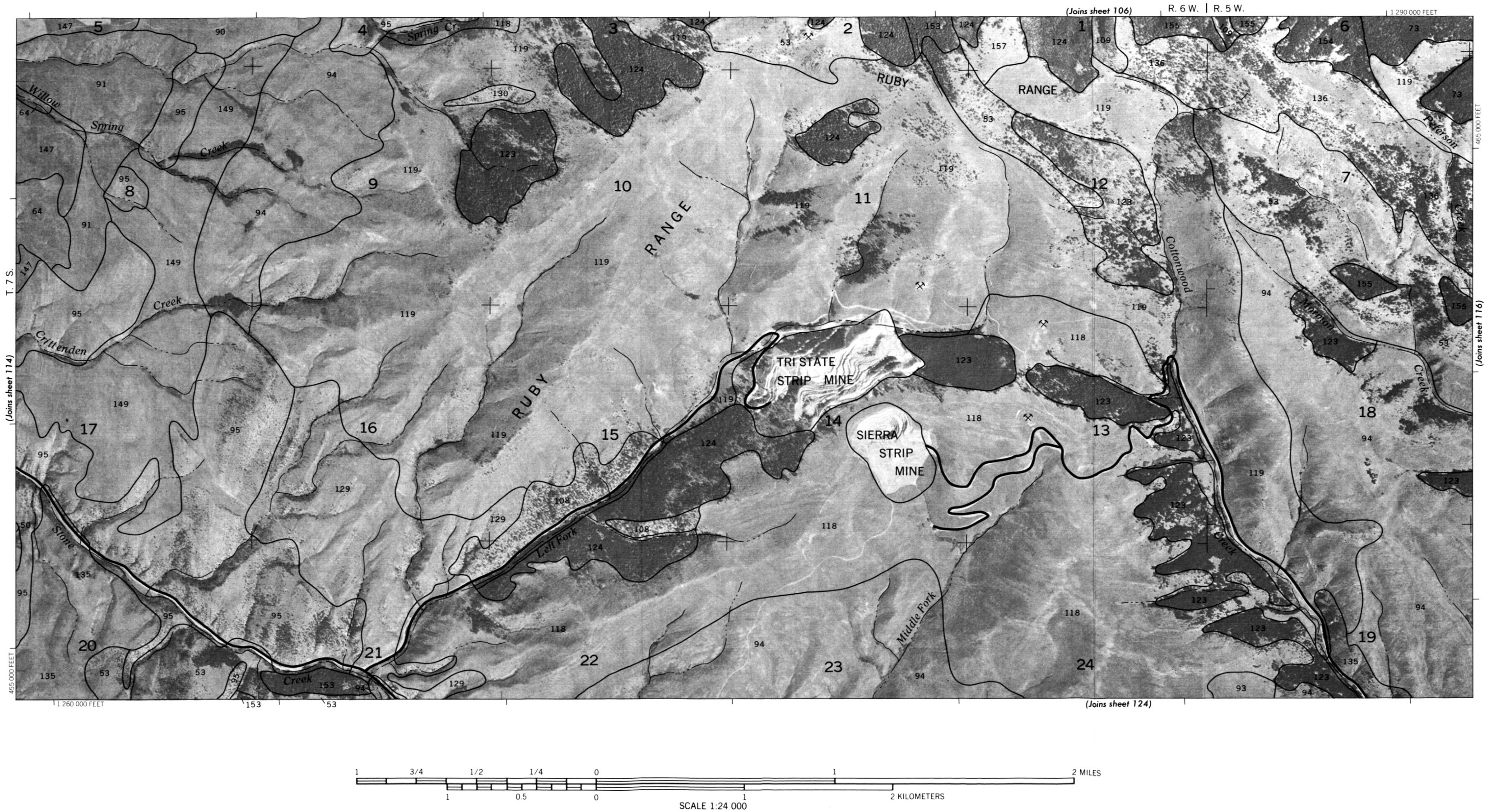
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 112

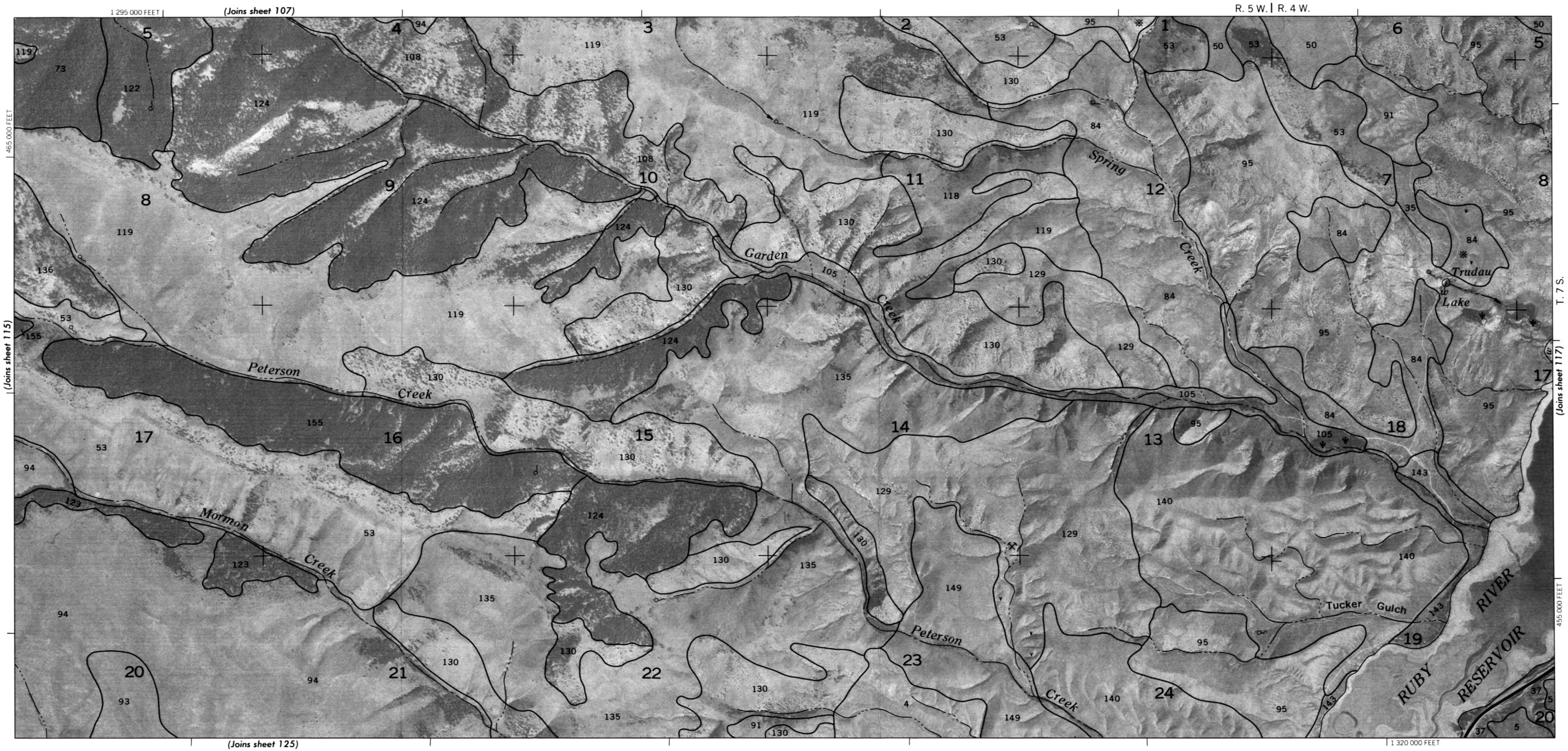

N
R. 2 E. | R. 3 E.
(Joins sheet 104)
1 515 000 FEET
475 000 FEET
(Joins sheet 112)
(Joins sheet 122)
1 485 000 FEET
465 000 FEET
T. 7 S. | T. 6 S.
BEAVERHEAD
NATIONAL
FOREST
RANGE
MADISON
FOREST BOUNDARY
NATIONAL
BEAVERHEAD
GALLATIN
SKI LIFT
Lone Mountain
BIG SKY SKI AREA
Sewage Lagoon
water
Middle Fk. of West Fk. Gallatin River
Andesite Peak
GALLATIN
NATIONAL
FOREST
MADISON COUNTY
GALLATIN COUNTY
LIMIT OF SOIL SURVEY
Jack Creek
South Fork
South Fk. of West Fk. Gallatin River
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 114


N
(Joins sheet 106)
R. 6 W. | R. 5 W.
1 290 000 FEET
465 000 FEET
(Joins sheet 116)
(Joins sheet 114)
T. 7 S.
455 000 FEET
1 260 000 FEET
(Joins sheet 124)
RUBY RANGE
RUBY
RANGE
TRI STATE STRIP MINE
SIERRA STRIP MINE
Willow Spring Creek
Crittenden Creek
Spring Cr.
Stone Creek
Left Fork
Middle Fork
Cottonwood Creek
Mormon Creek
Peterson Creek
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

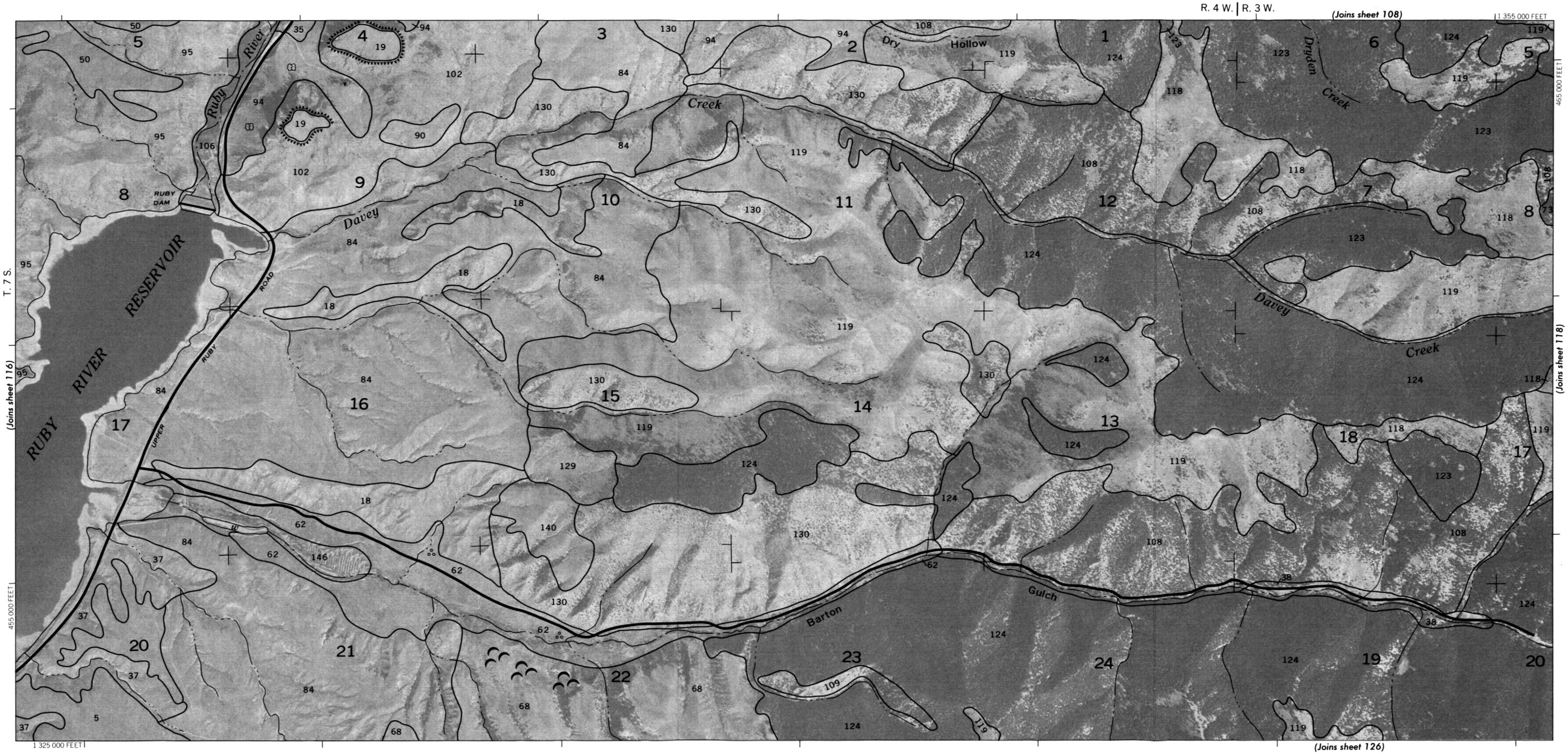
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 116



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

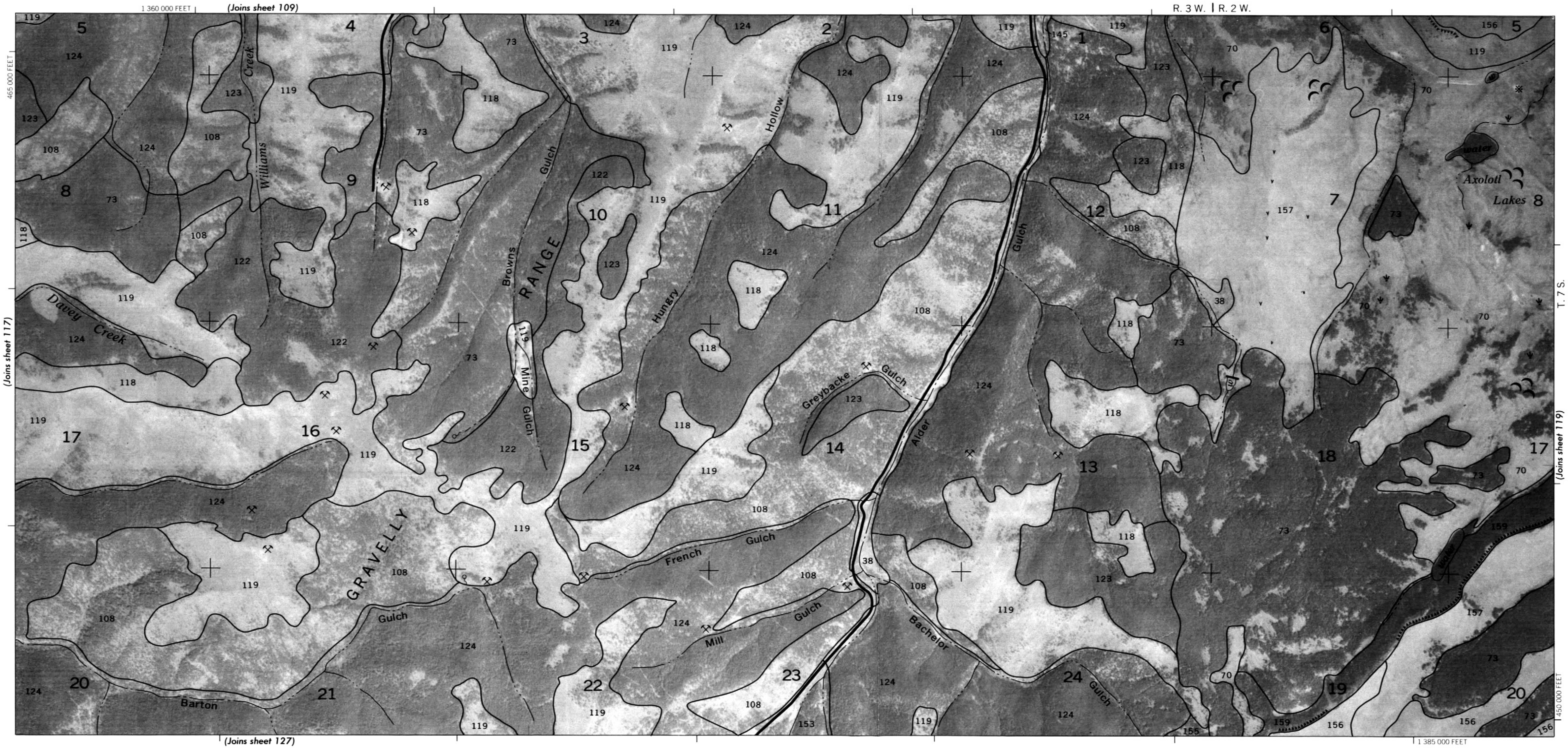
SCALE 1:24 000



1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

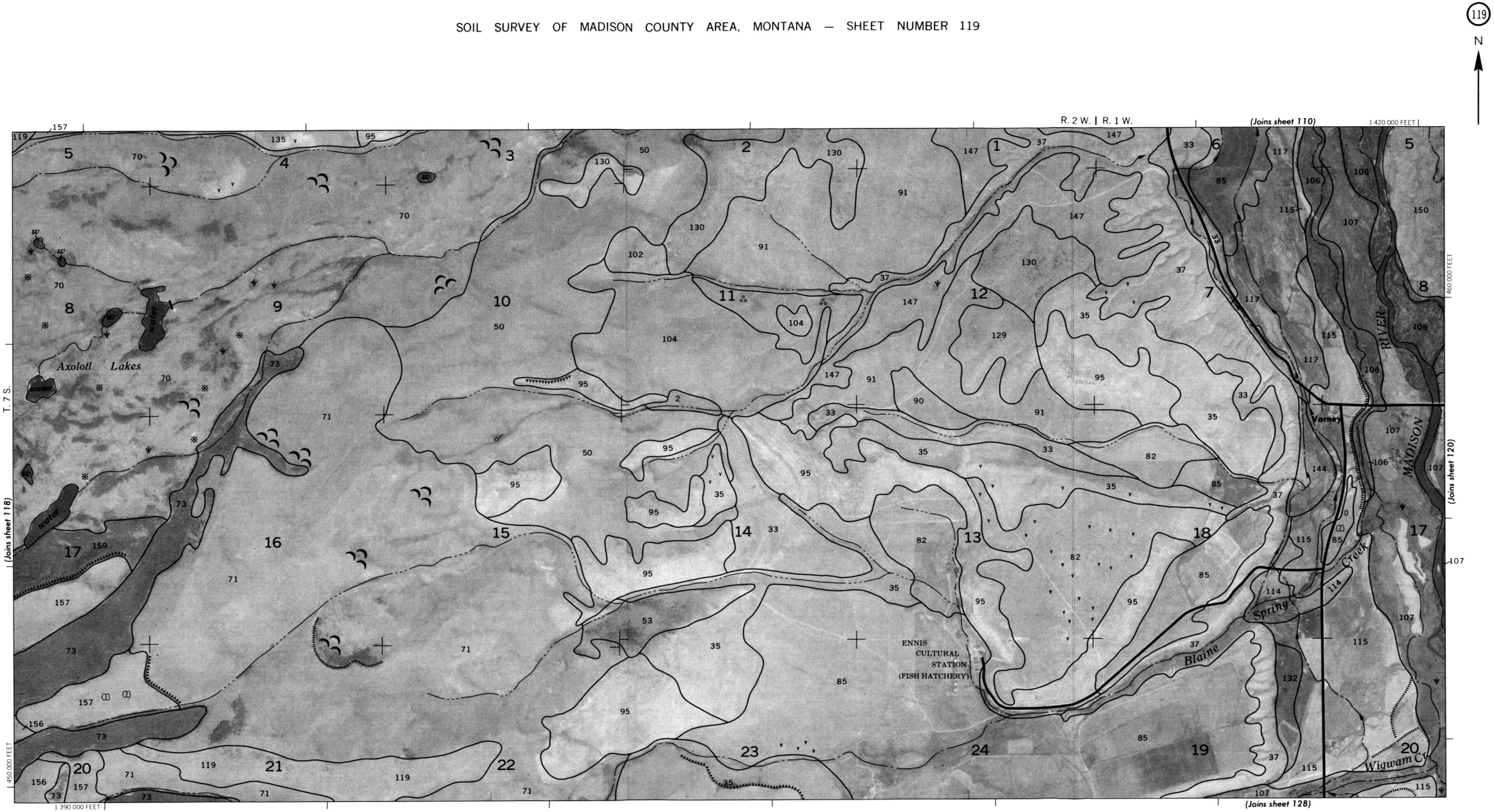
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 118

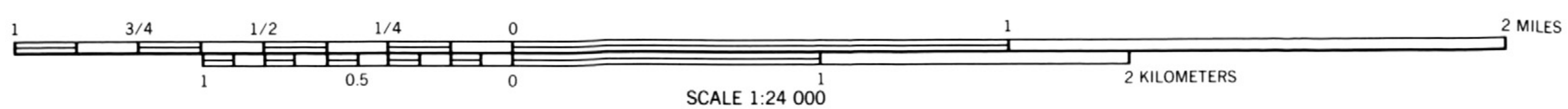


1 3/4 1/2 1/4 0 1 2 MILES

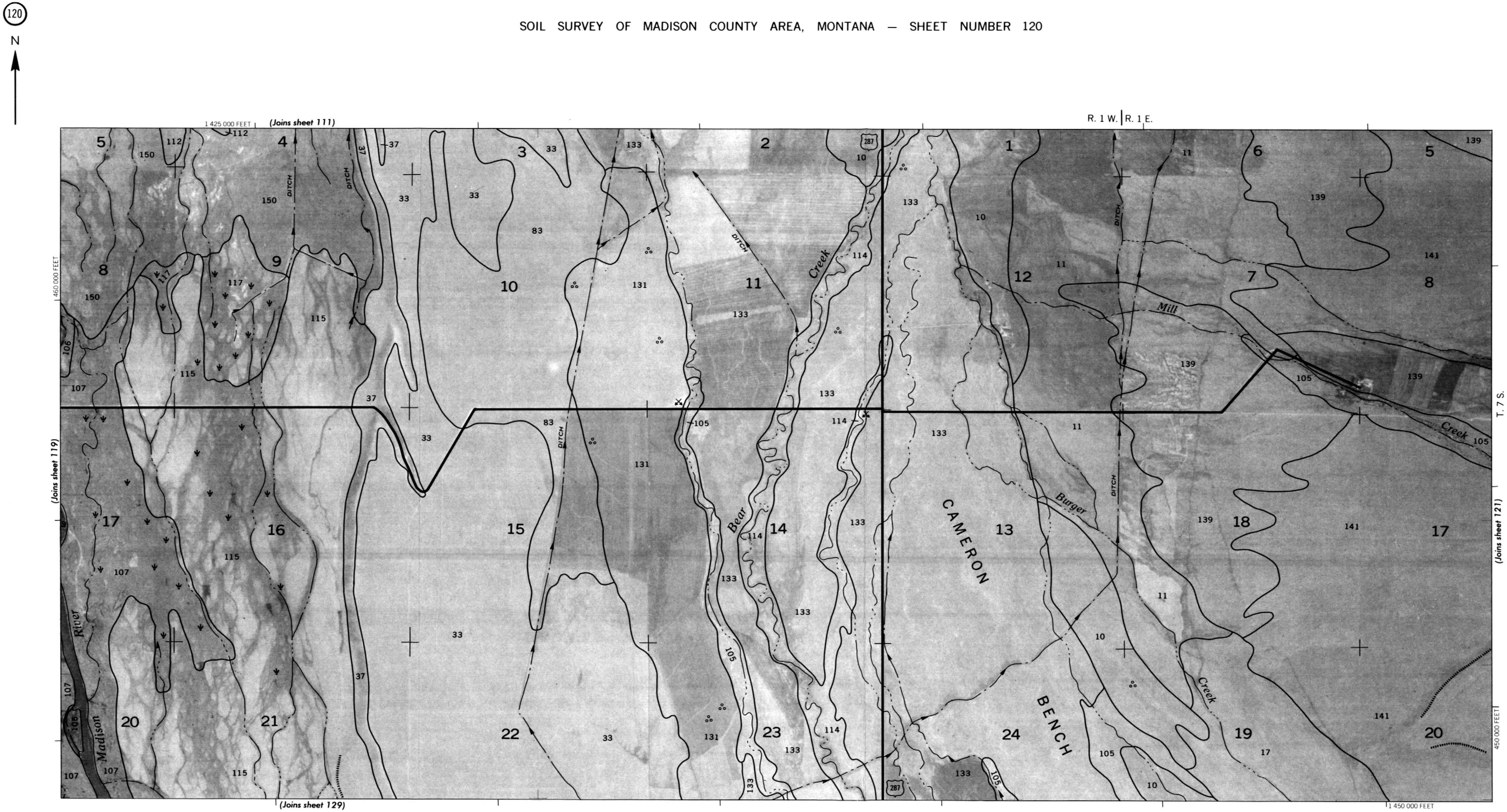
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000


N
R. 2 W. | R. 1 W.
(Joins sheet 110)
1 420 000 FEET
T. 7 S.
(Joins sheet 118)
(Joins sheet 120)
(Joins sheet 128)
460 000 FEET
450 000 FEET
1 390 000 FEET
Axolotl Lakes
water
Varney
MADISON
RIVER
Spring
Creek
Blaine
Wigwam Cr
ENNIS
CULTURAL
STATION
(FISH HATCHERY)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24


1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 120

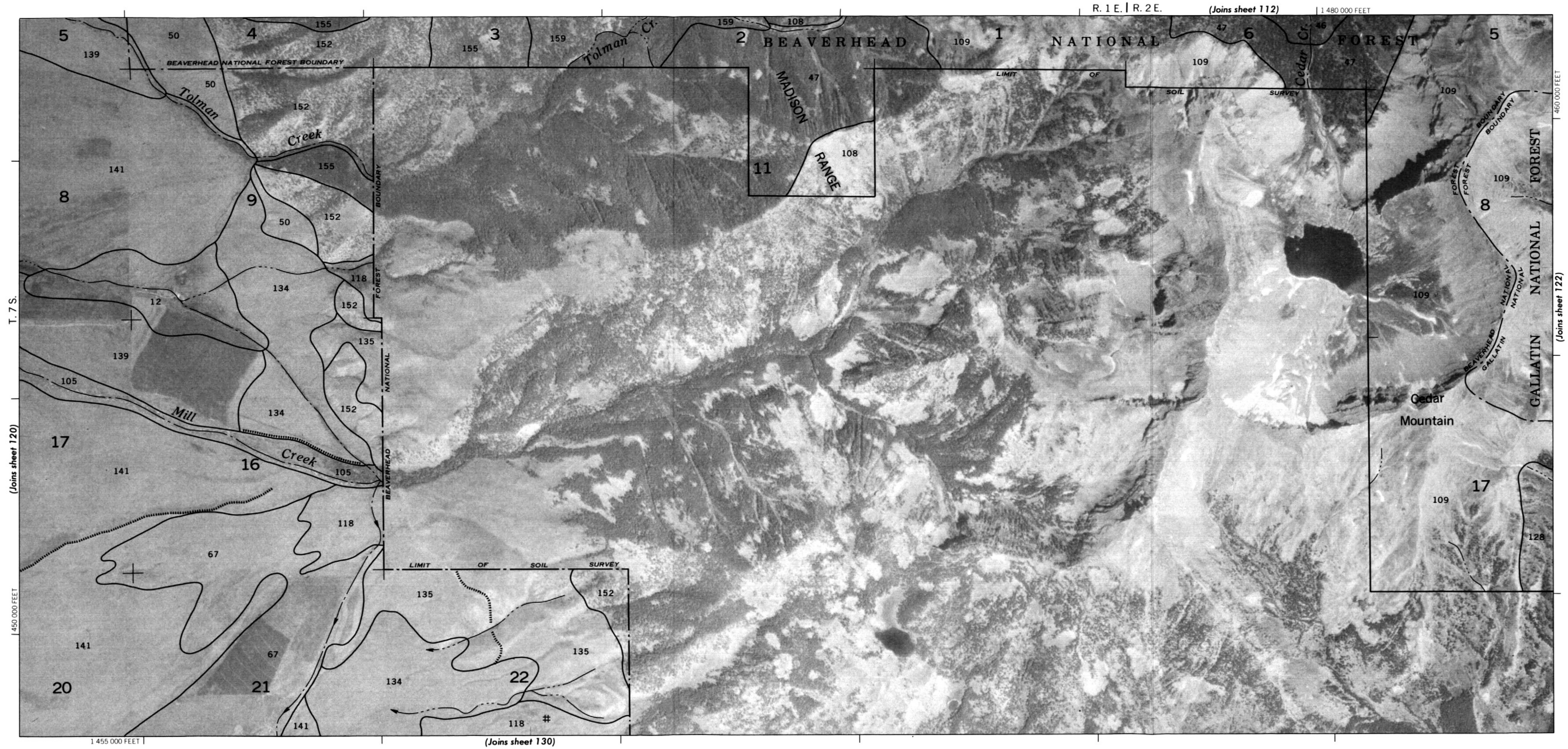


SCALE 1:24 000

1 3/4 1/2 1/4 0 1 2 MILES

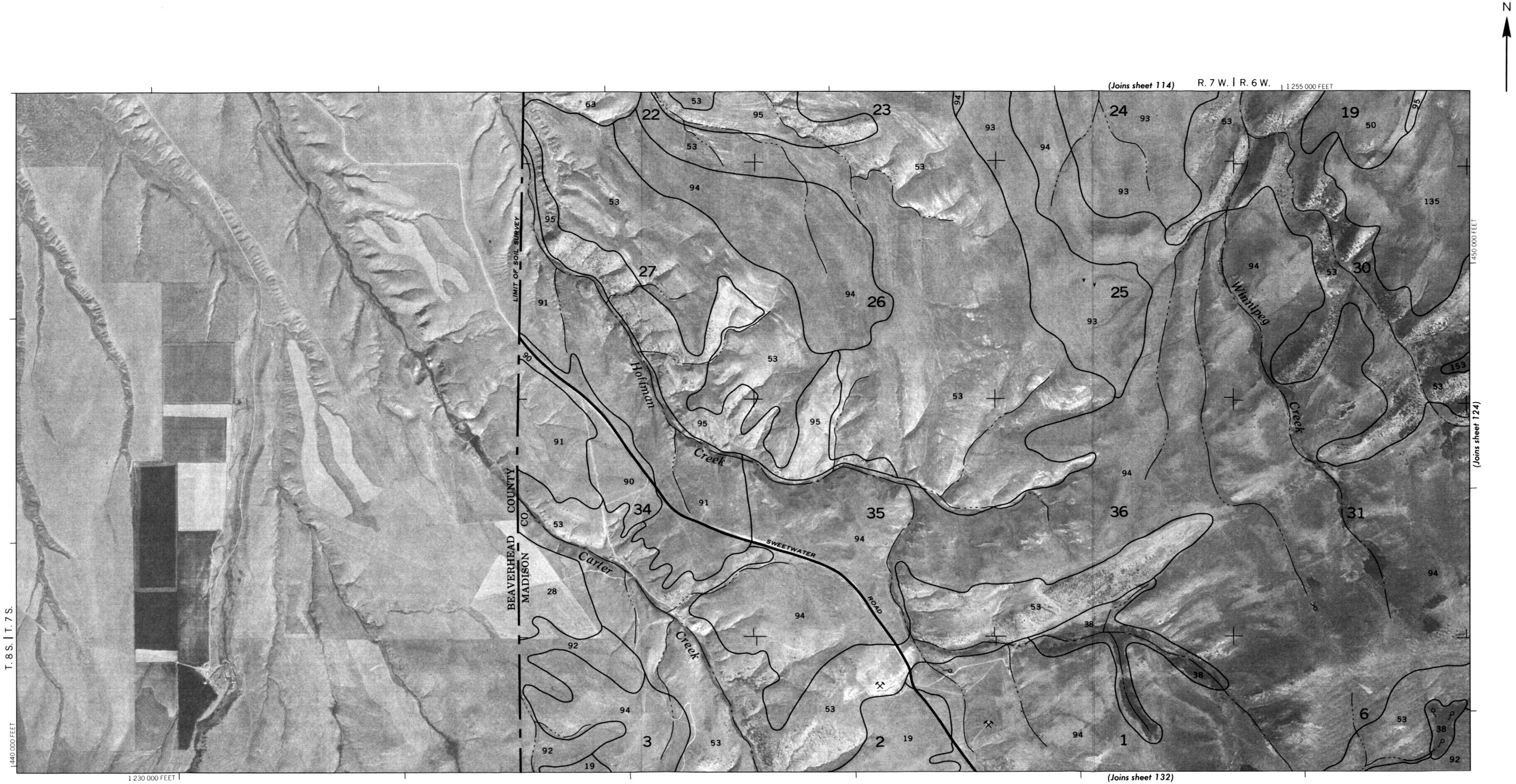
1 0.5 0 1 2 KILOMETERS

121



1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 122

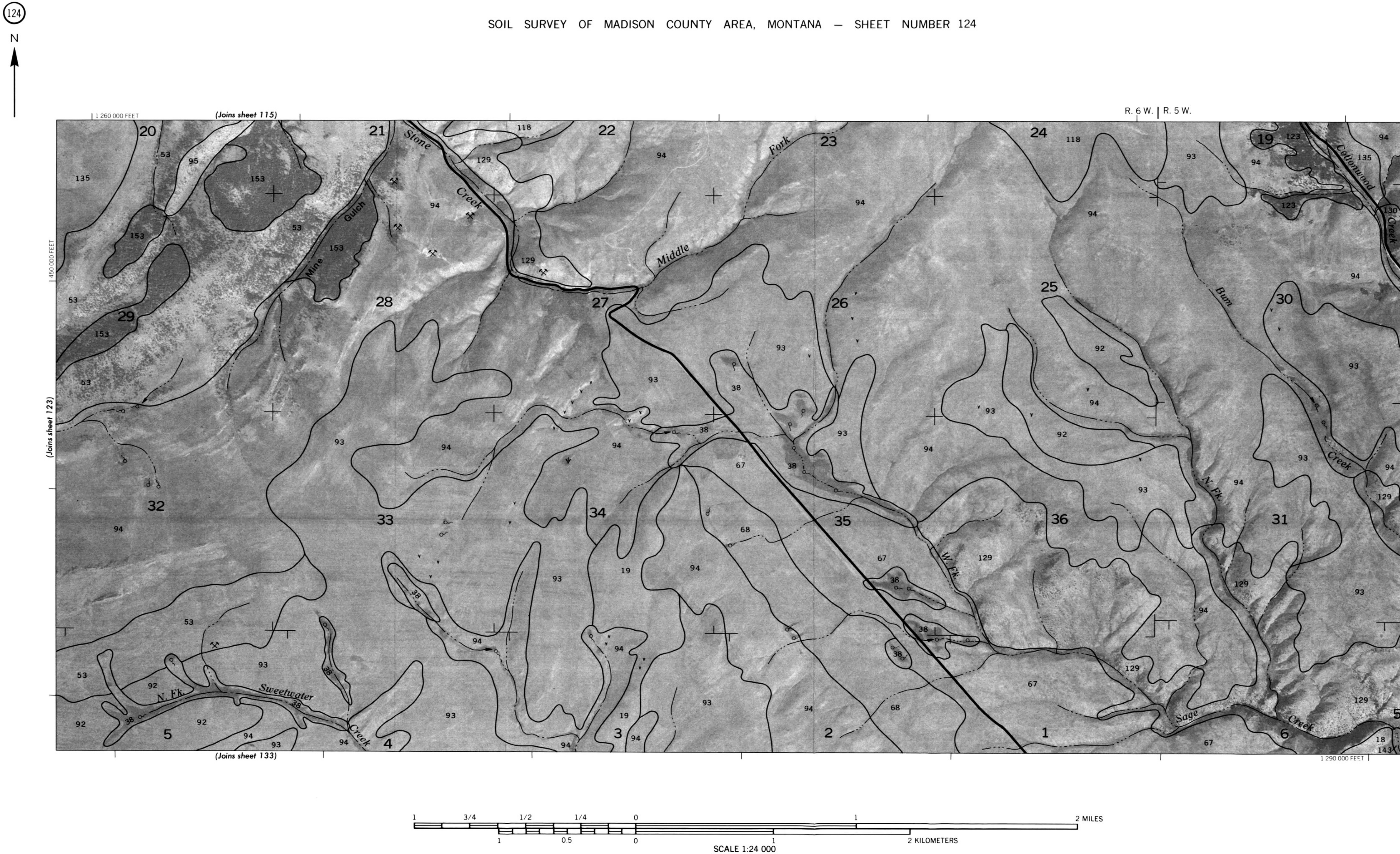


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 124



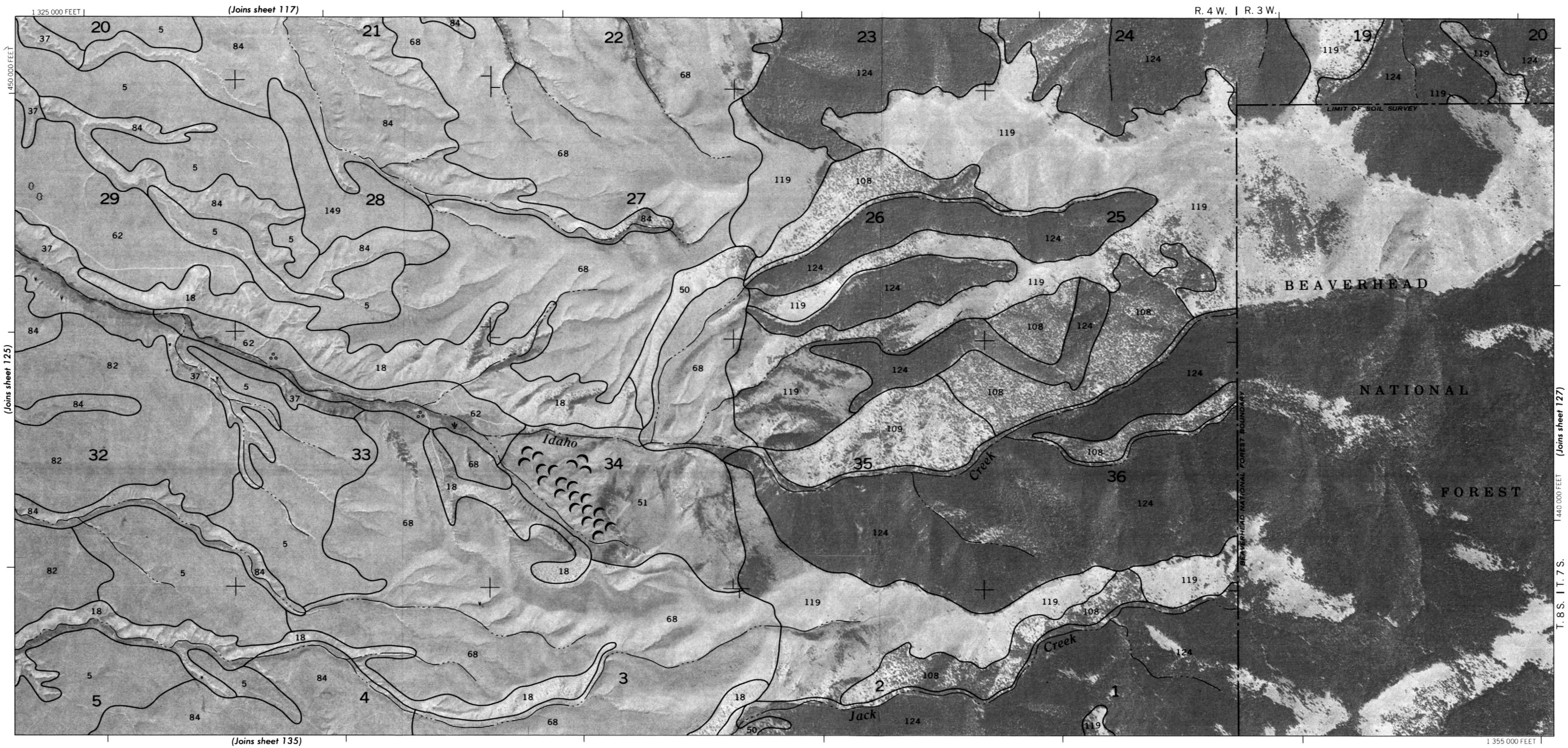
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 126



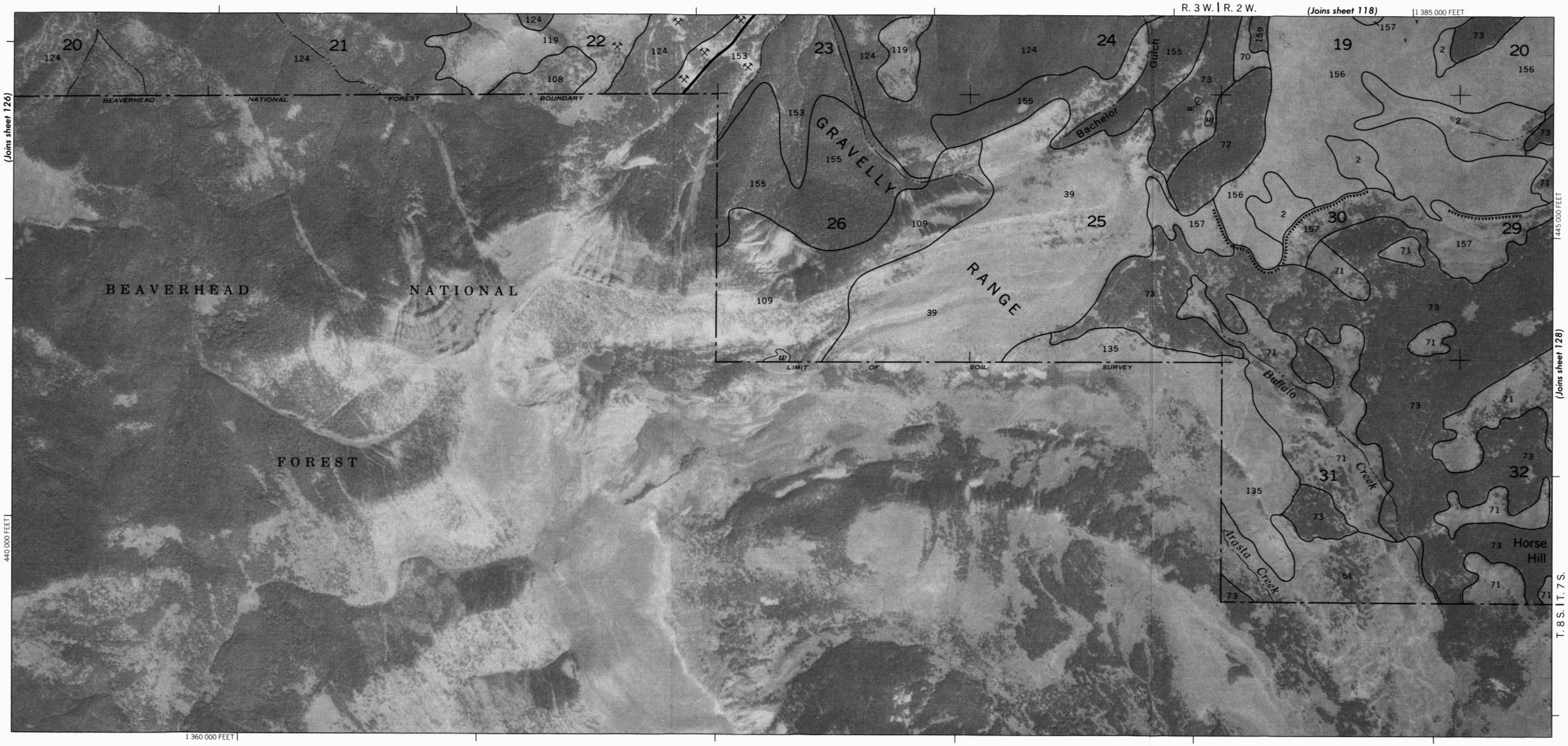
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 127

127



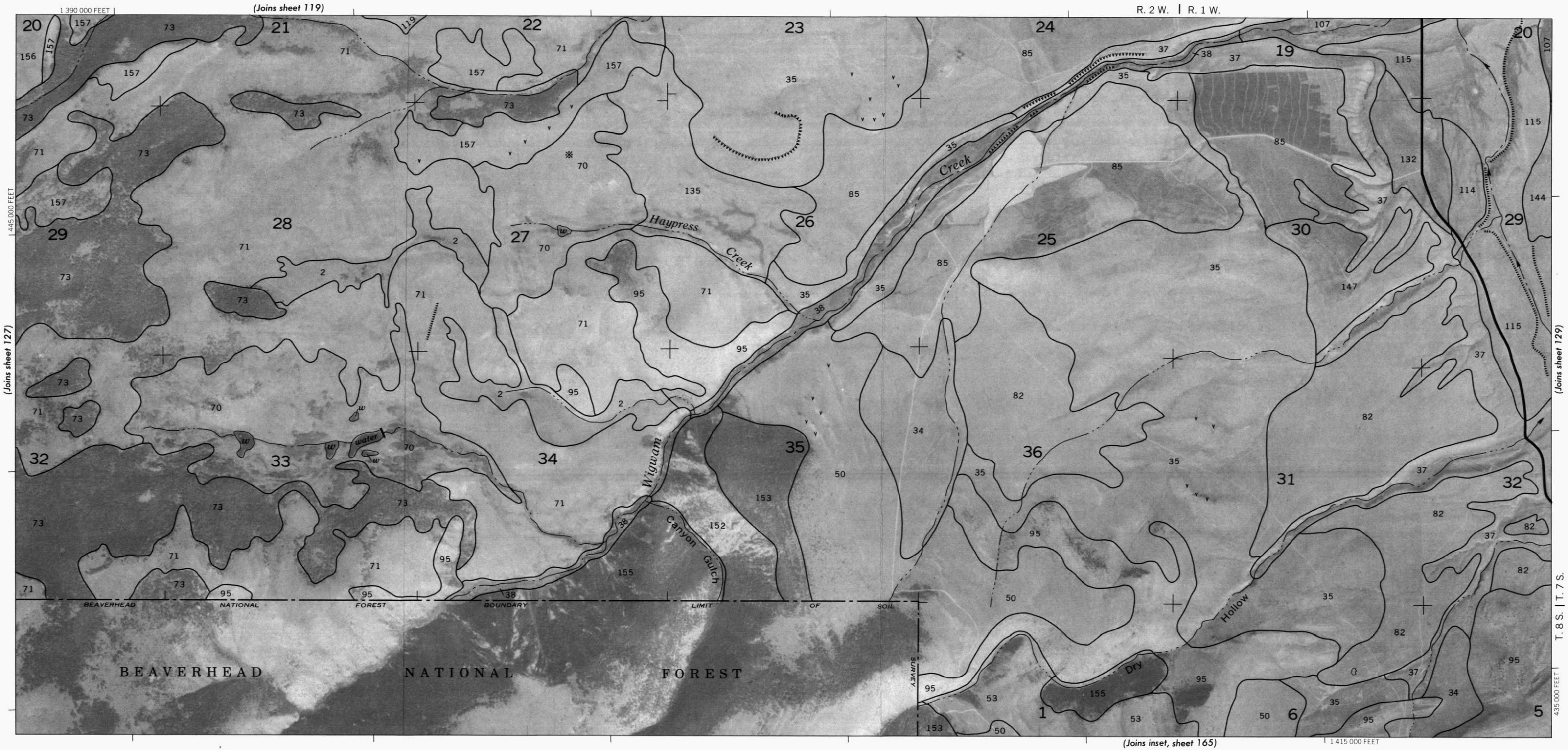
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 128

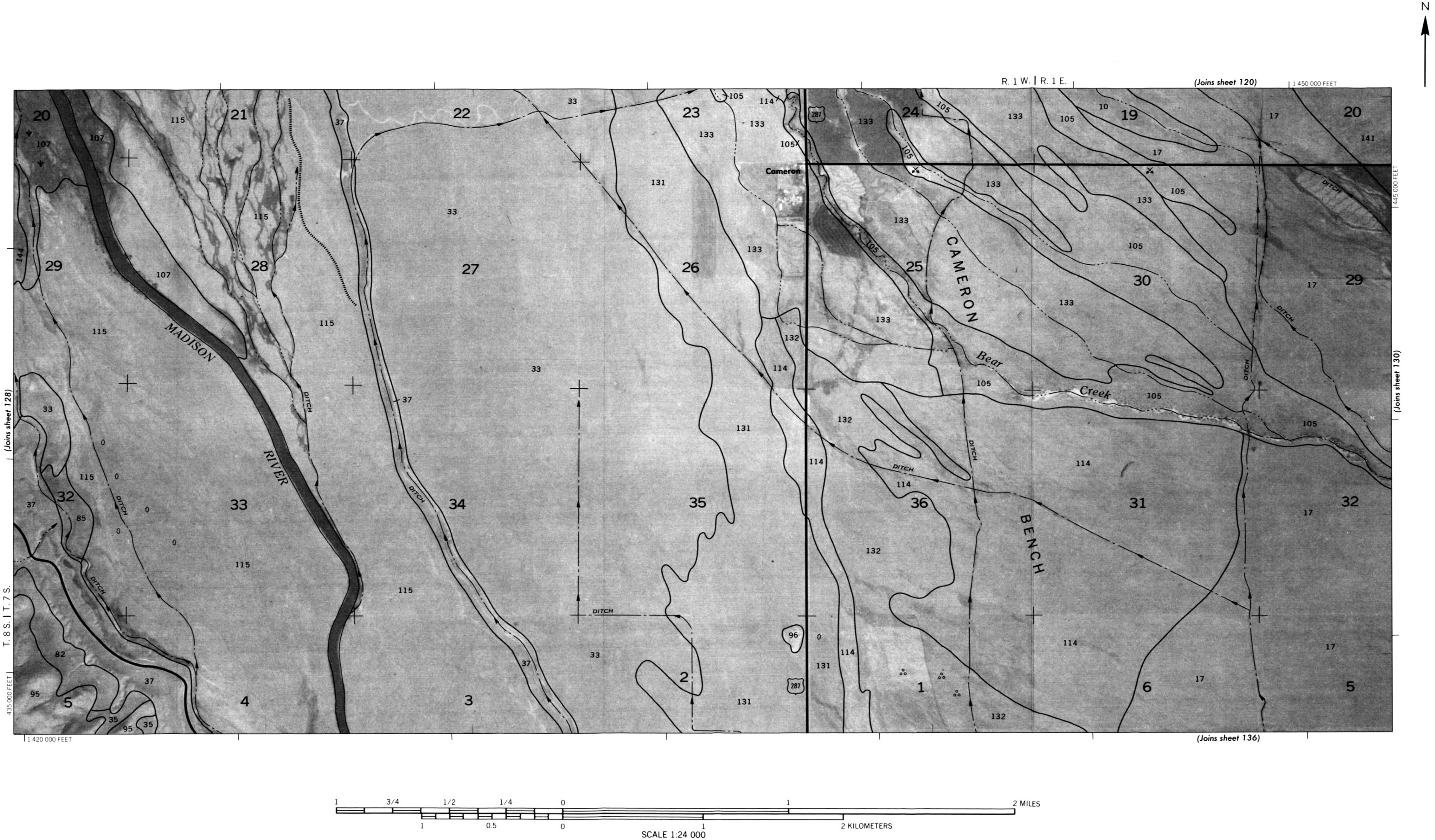
N



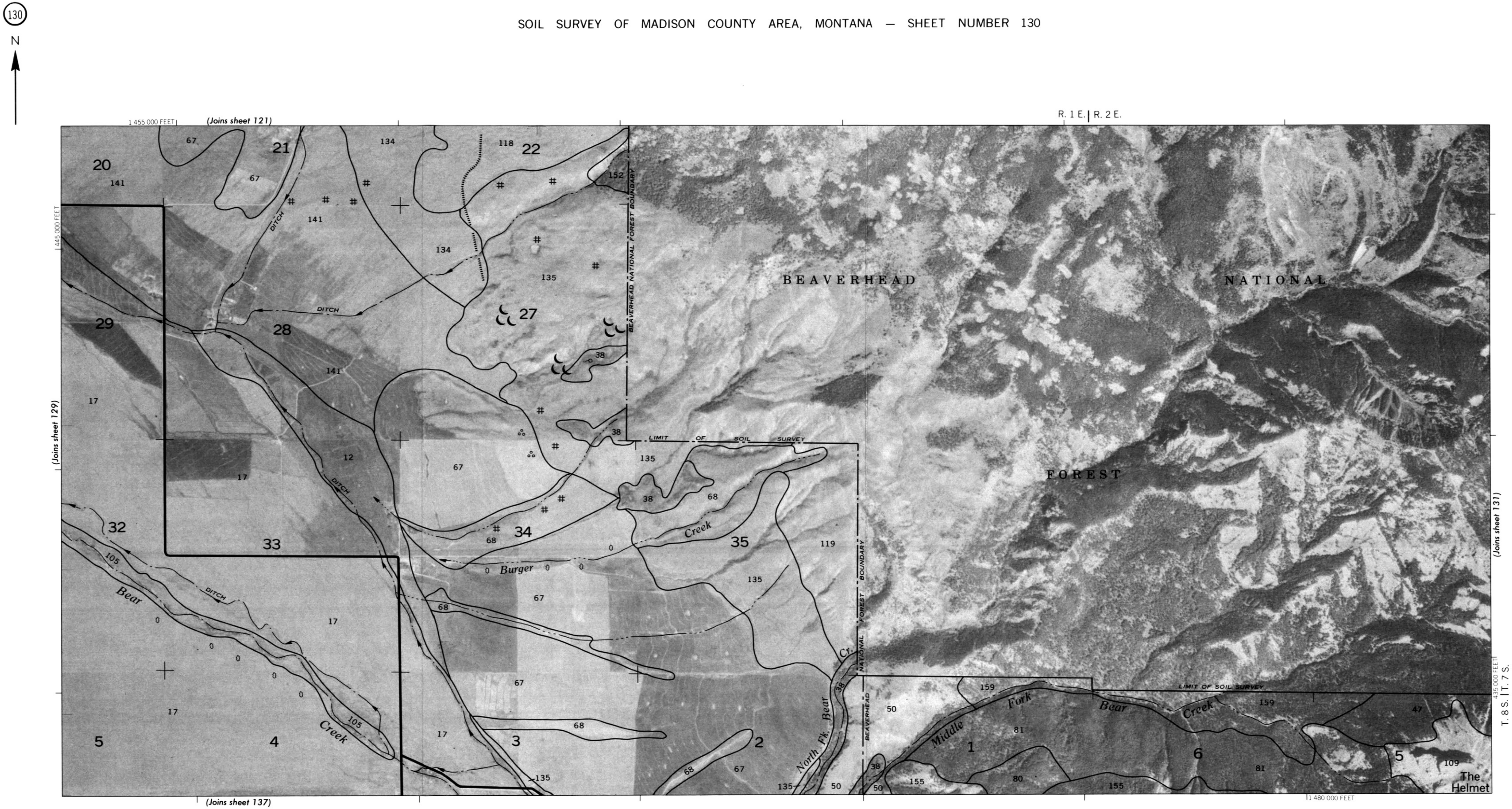
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000


N
R. 1 W. | R. 1 E.
(Joins sheet 120)
1 450 000 FEET
(Joins sheet 128)
(Joins sheet 130)
(Joins sheet 136)
1 420 000 FEET
435 000 FEET
445 000 FEET
T. 8 S. | T. 7 S.
MADISON
RIVER
CAMERON
BENCH
Bear
Creek
Cameron
DITCH
287
SCALE 1:24 000
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 130

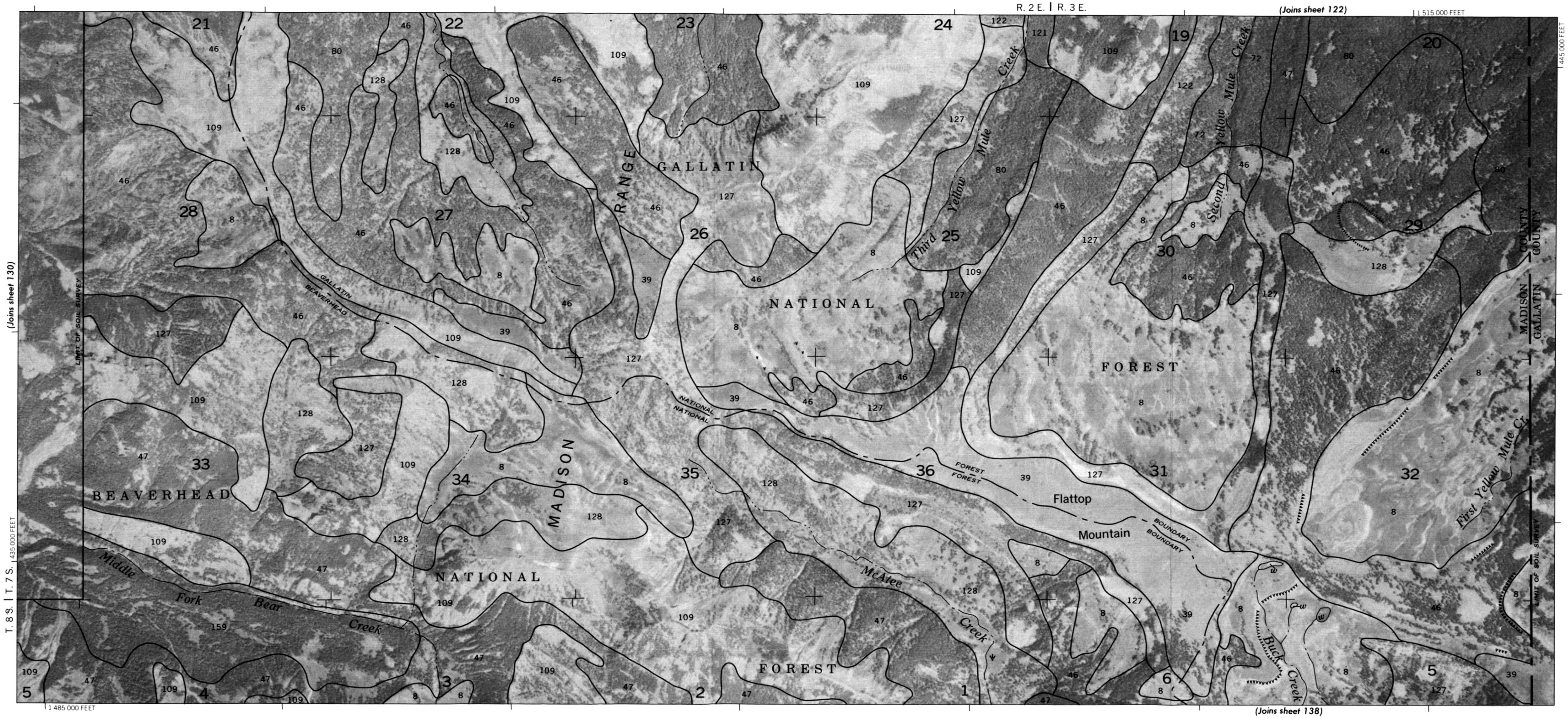


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

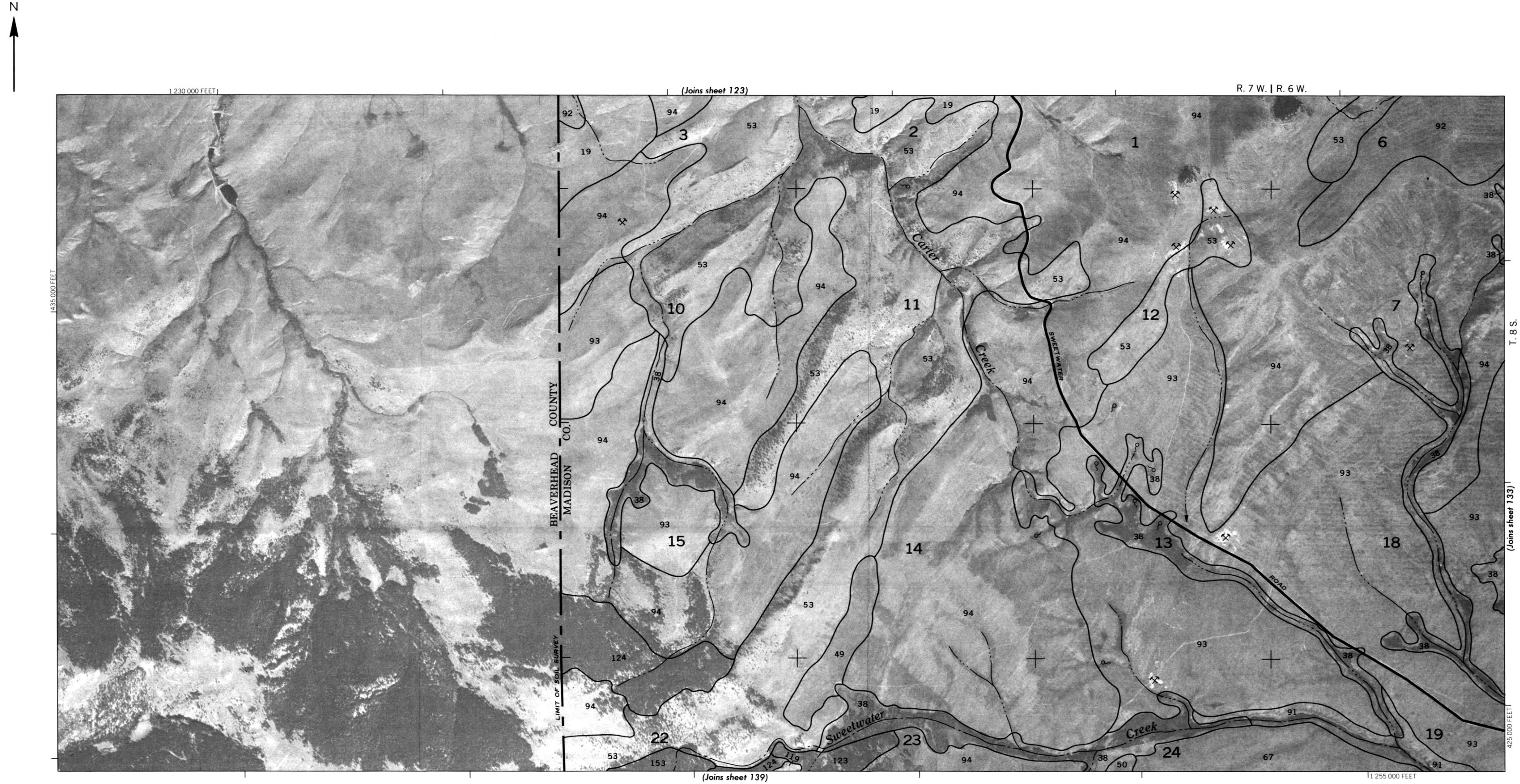


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 132



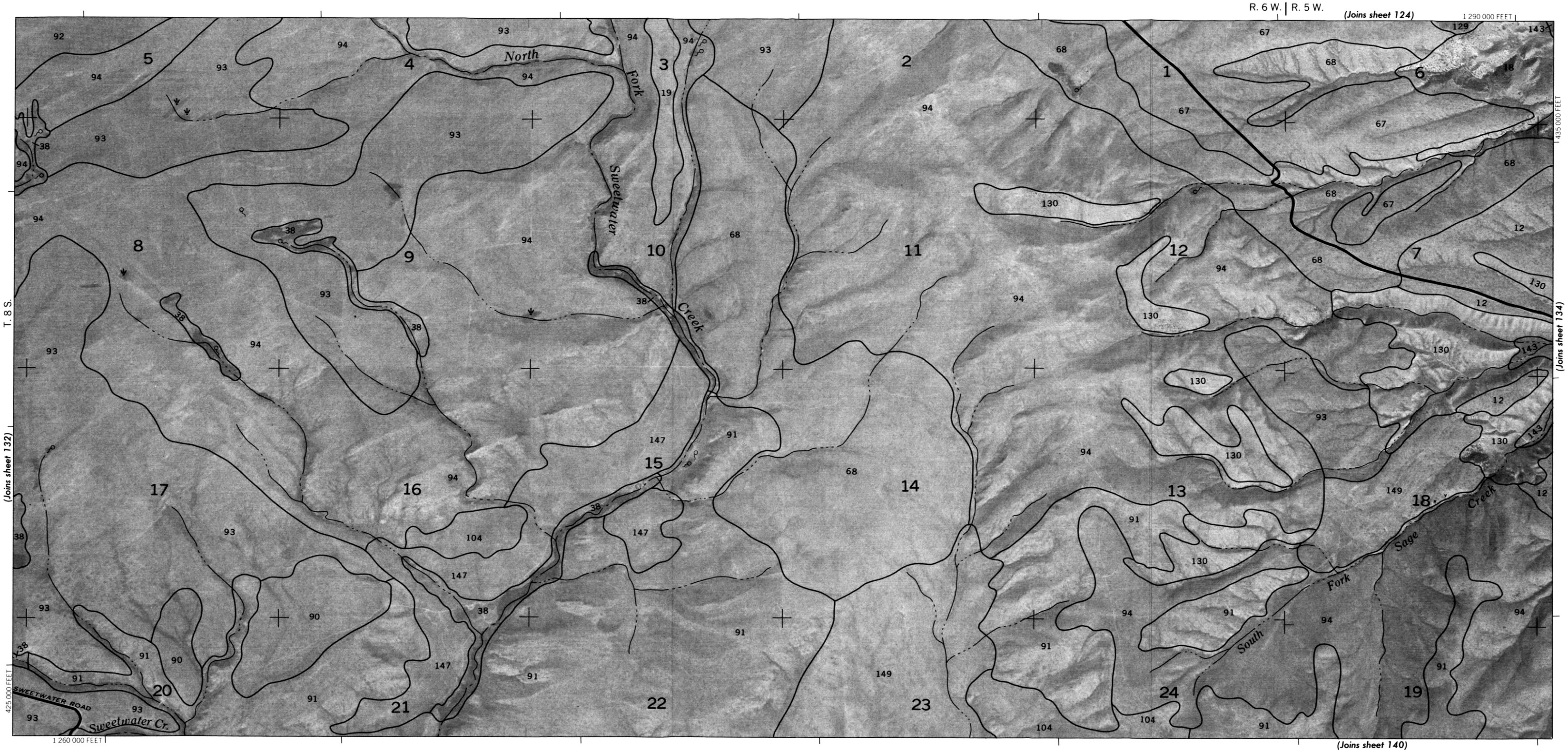
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

133

N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

134

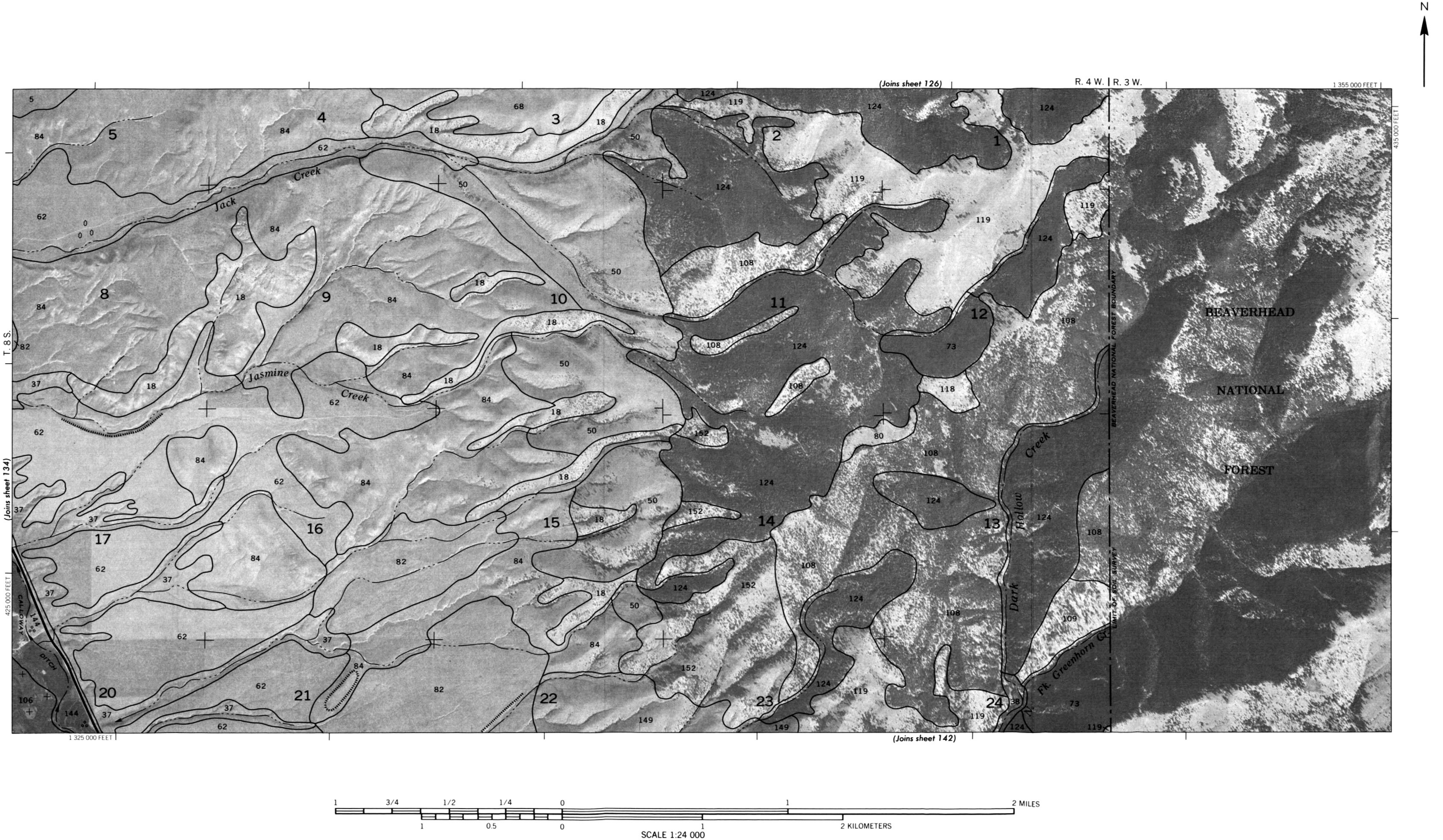
N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 134

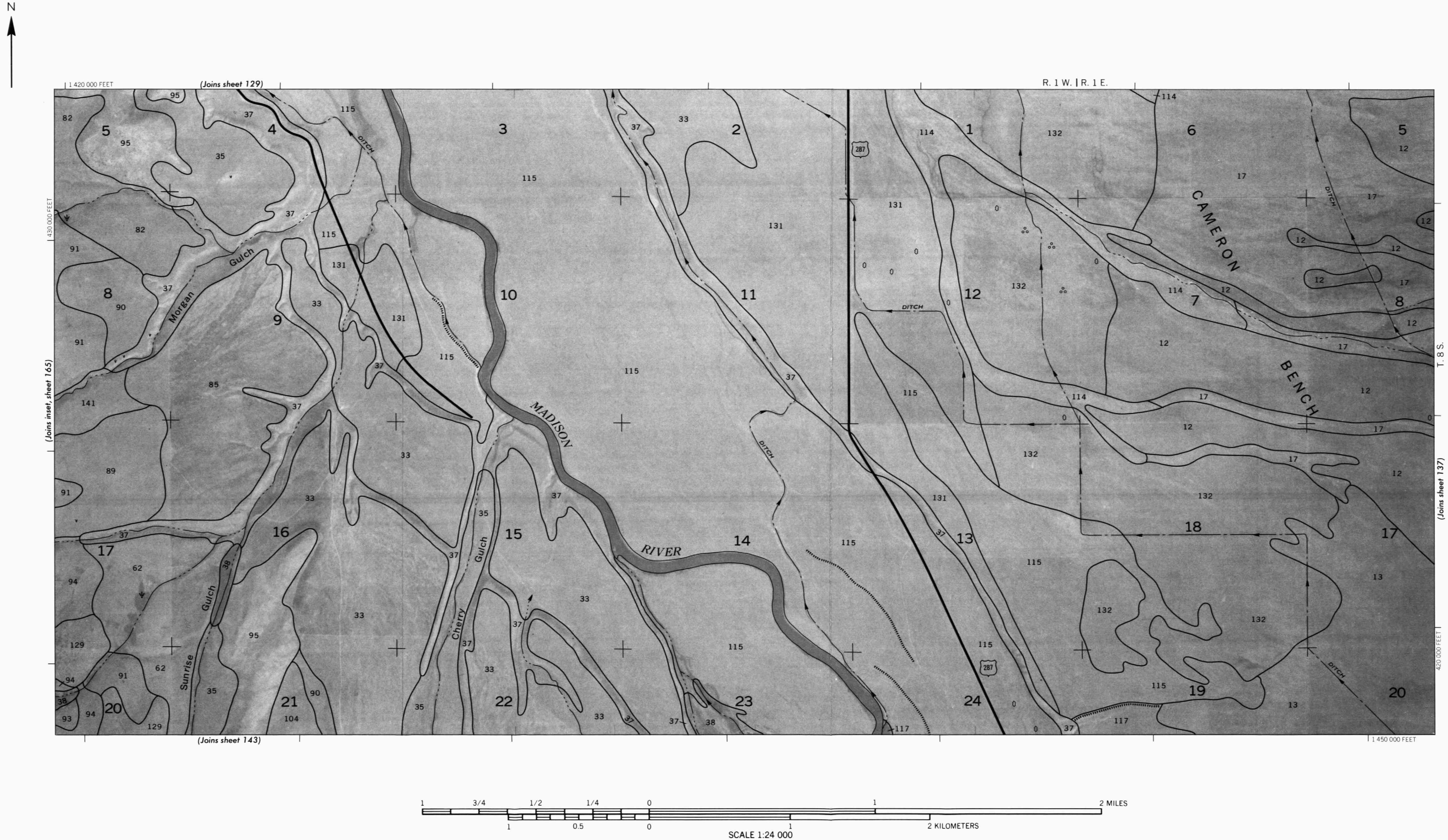
1 3/4 1/2 1/4 0 1 2 MILES

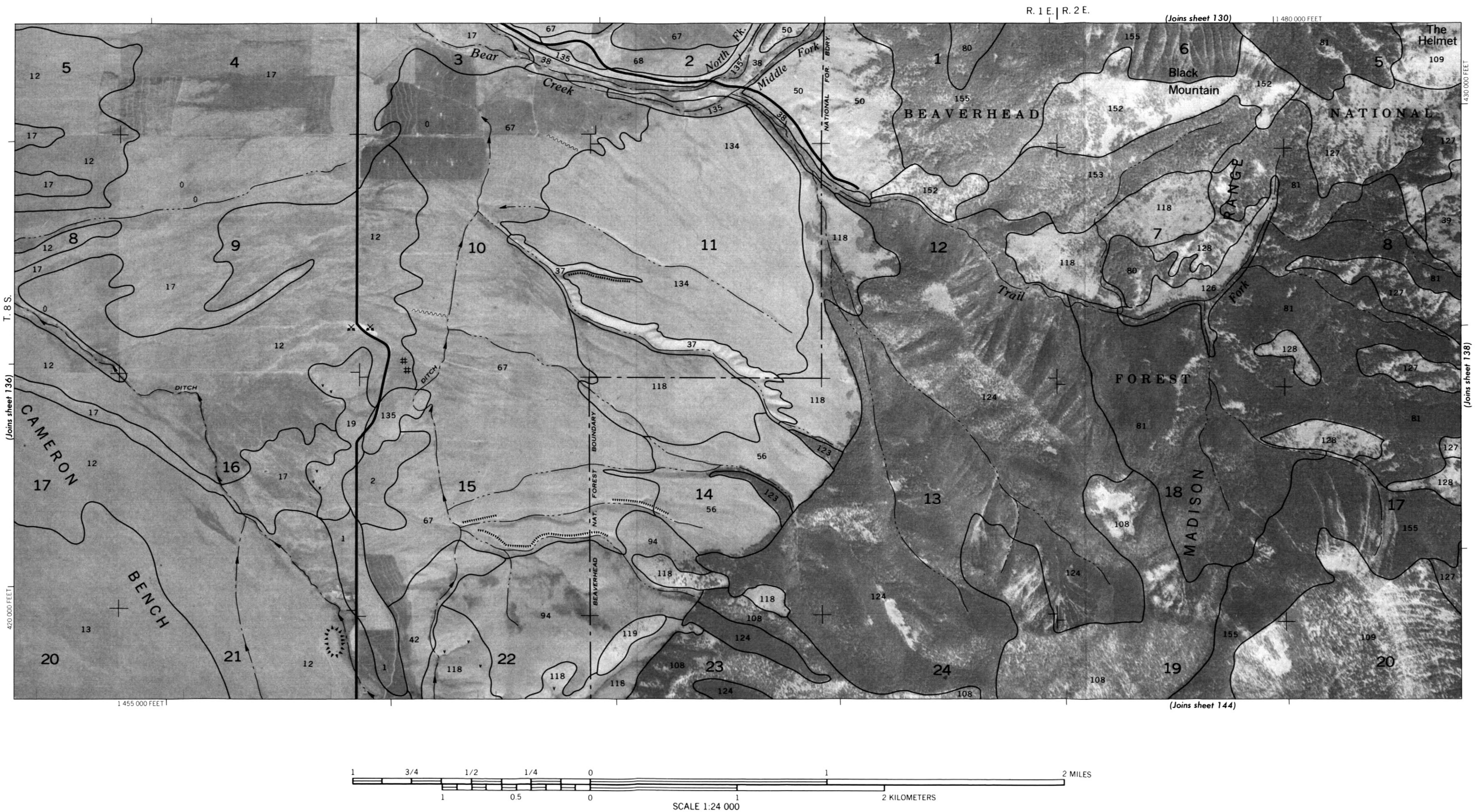
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

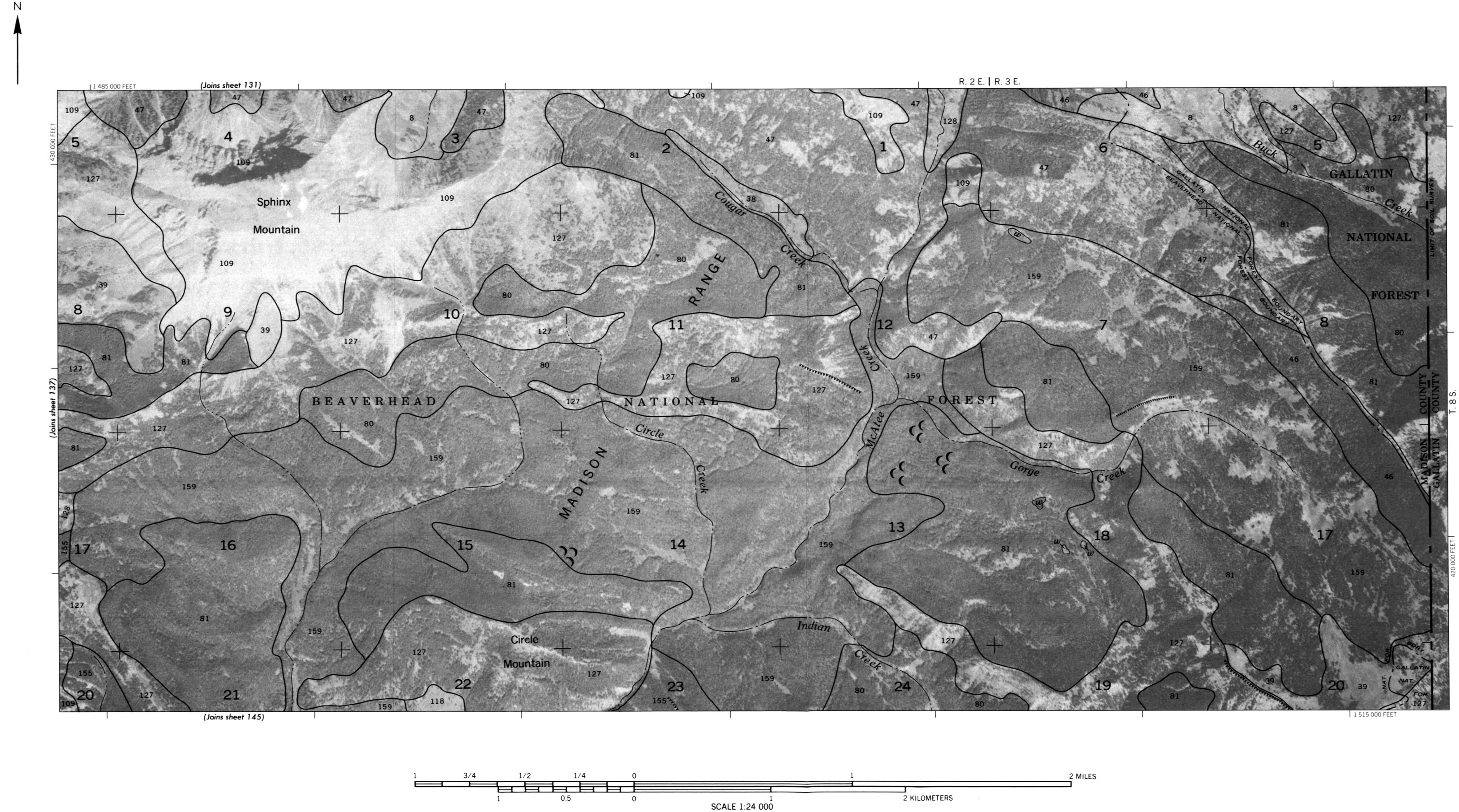

N
(Joins sheet 126)
R. 4 W.
R. 3 W.
1 355 000 FEET
435 000 FEET
T. 8 S.
(Joins sheet 134)
425 000 FEET
1 325 000 FEET
(Joins sheet 142)
Jack Creek
Jasmine Creek
Dark Hollow Creek
N. Fk. Greenhorn Cr.
CALLOWAY DITCH
BEAVERHEAD NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST BOUNDARY
LIMIT OF SOIL SURVEY
1 2 3 4 5 8 9 10 11 12 13 14 15 16 17 20 21 22 23 24
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 136




N
R. 1 E. | R. 2 E.
(Joins sheet 130)
1 480 000 FEET
430 000 FEET
(Joins sheet 136)
(Joins sheet 138)
(Joins sheet 144)
T. 8 S.
420 000 FEET
1 455 000 FEET
Bear
Creek
North Fk.
Middle
Fork
NATIONAL FOR. BDRY.
BEAVERHEAD
NATIONAL
RANGE
FOREST
MADISON
Trail
Fork
Black
Mountain
The
Helmet
CAMERON
BENCH
DITCH
BEAVERHEAD NAT. FOREST BOUNDARY
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 138



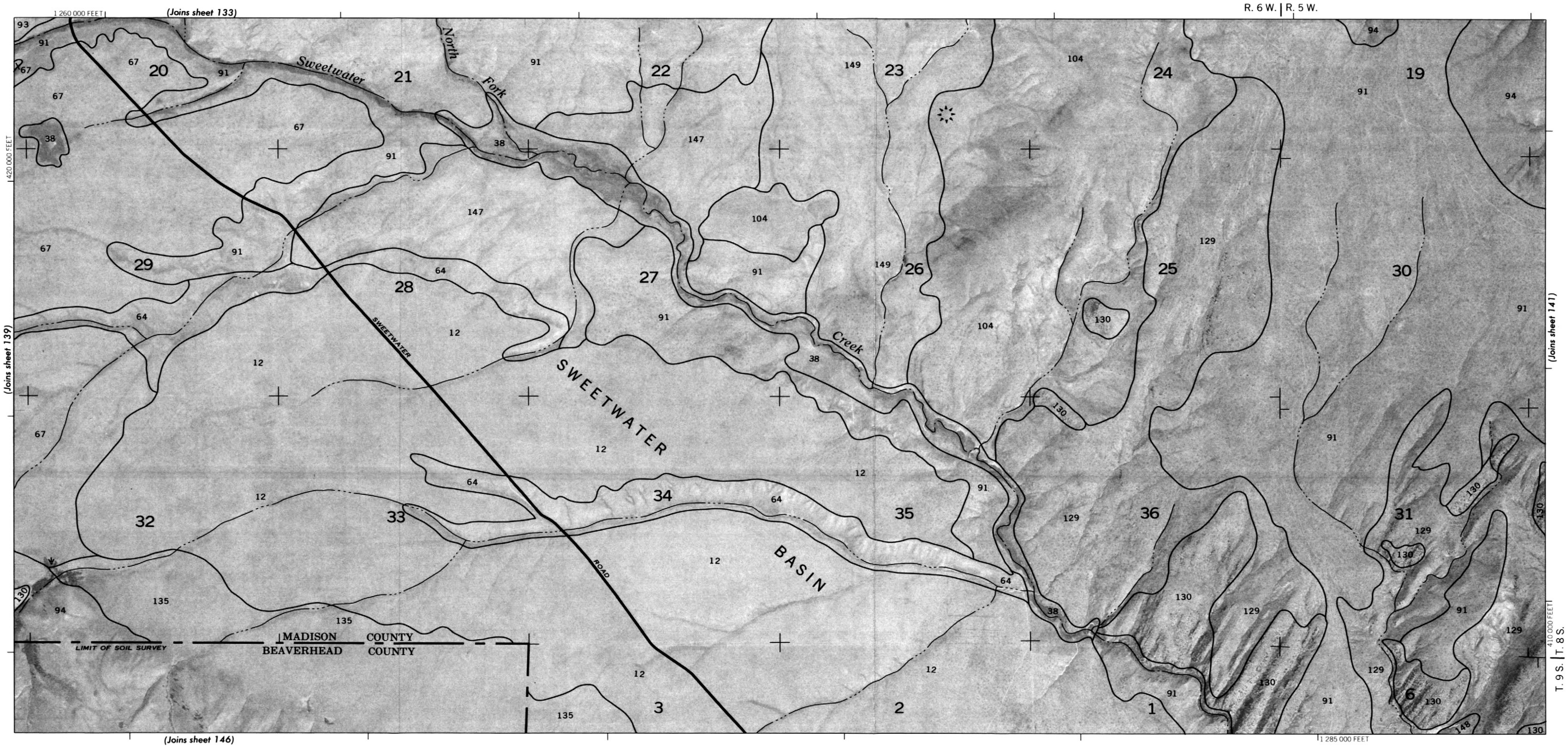
N

SCALE 1:24 000

140

N

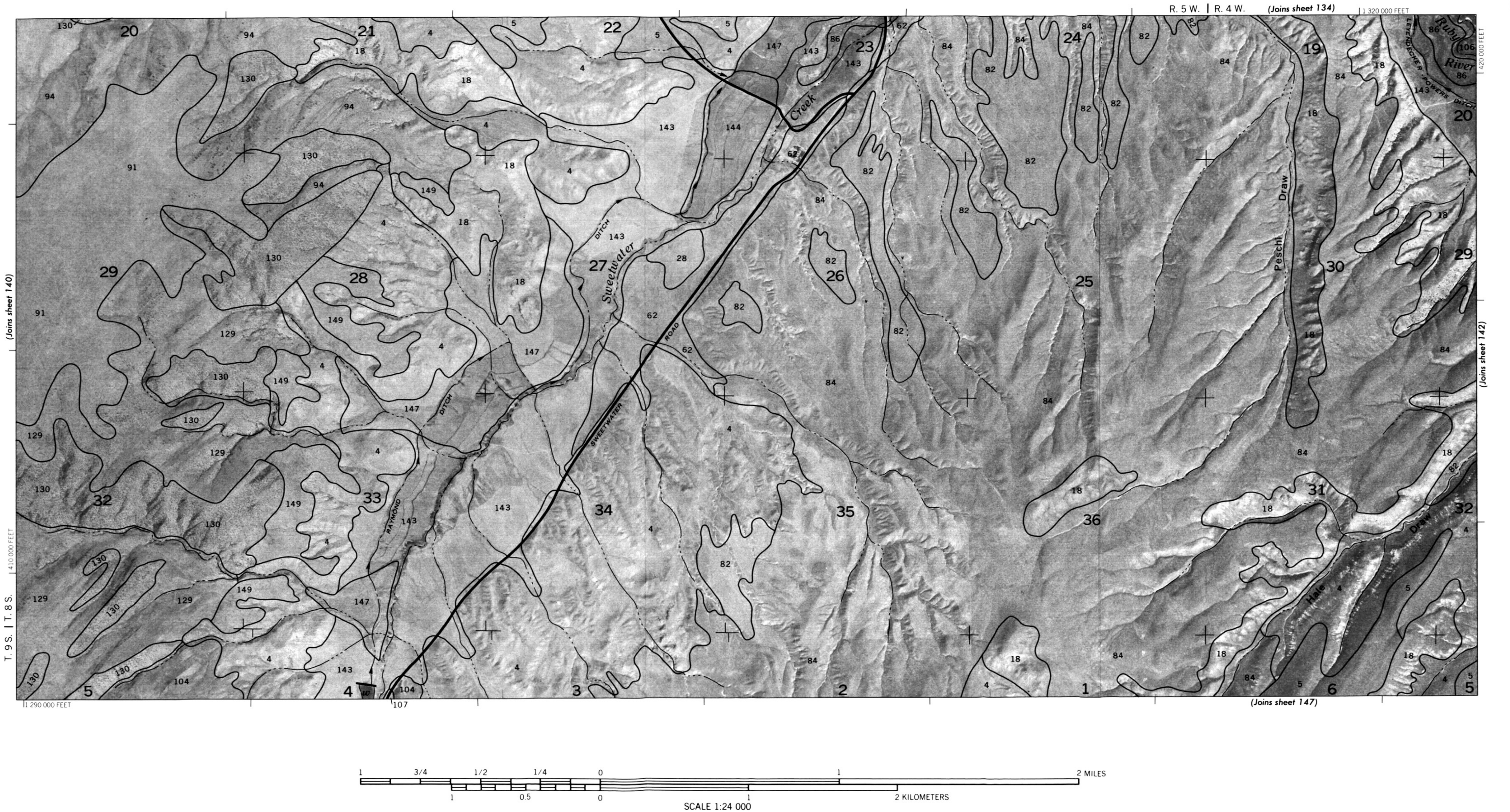
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 140



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000


N
R. 5 W. | R. 4 W.
(Joins sheet 134)
1 320 000 FEET
(Joins sheet 140)
(Joins sheet 142)
(Joins sheet 147)
420 000 FEET
410 000 FEET
1 290 000 FEET
T. 9 S. | T. 8 S.
Sweetwater
Creek
Ruby River
Pesch Draw
Hale Draw
SWEETWATER ROAD
RAYMOND DITCH
LEVENGOOD & POWERS DITCH
DITCH
1
2
3
4
5
6
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
107
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

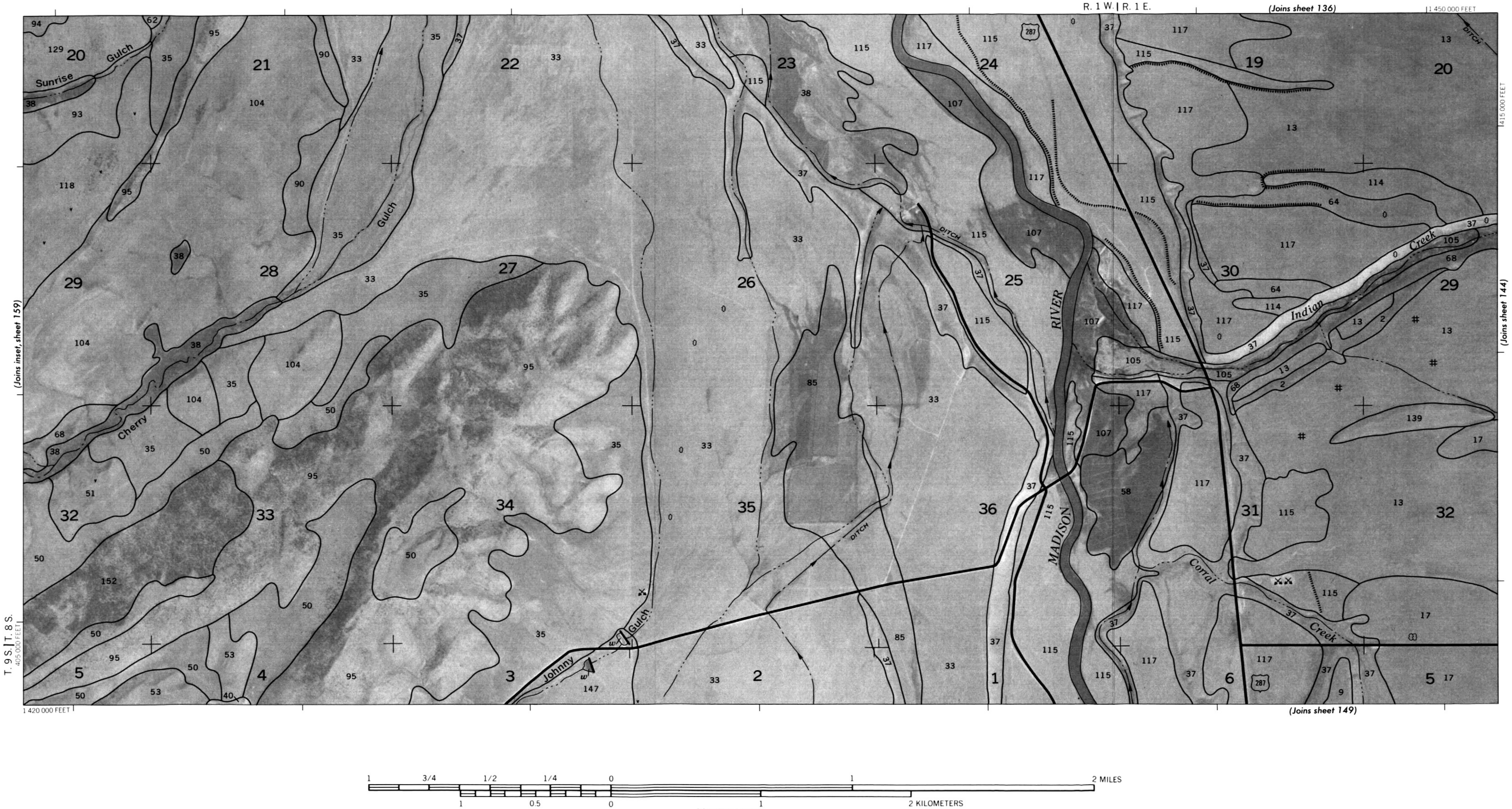
N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 142

1 3/4 1/2 1/4 0 1 2 MILES

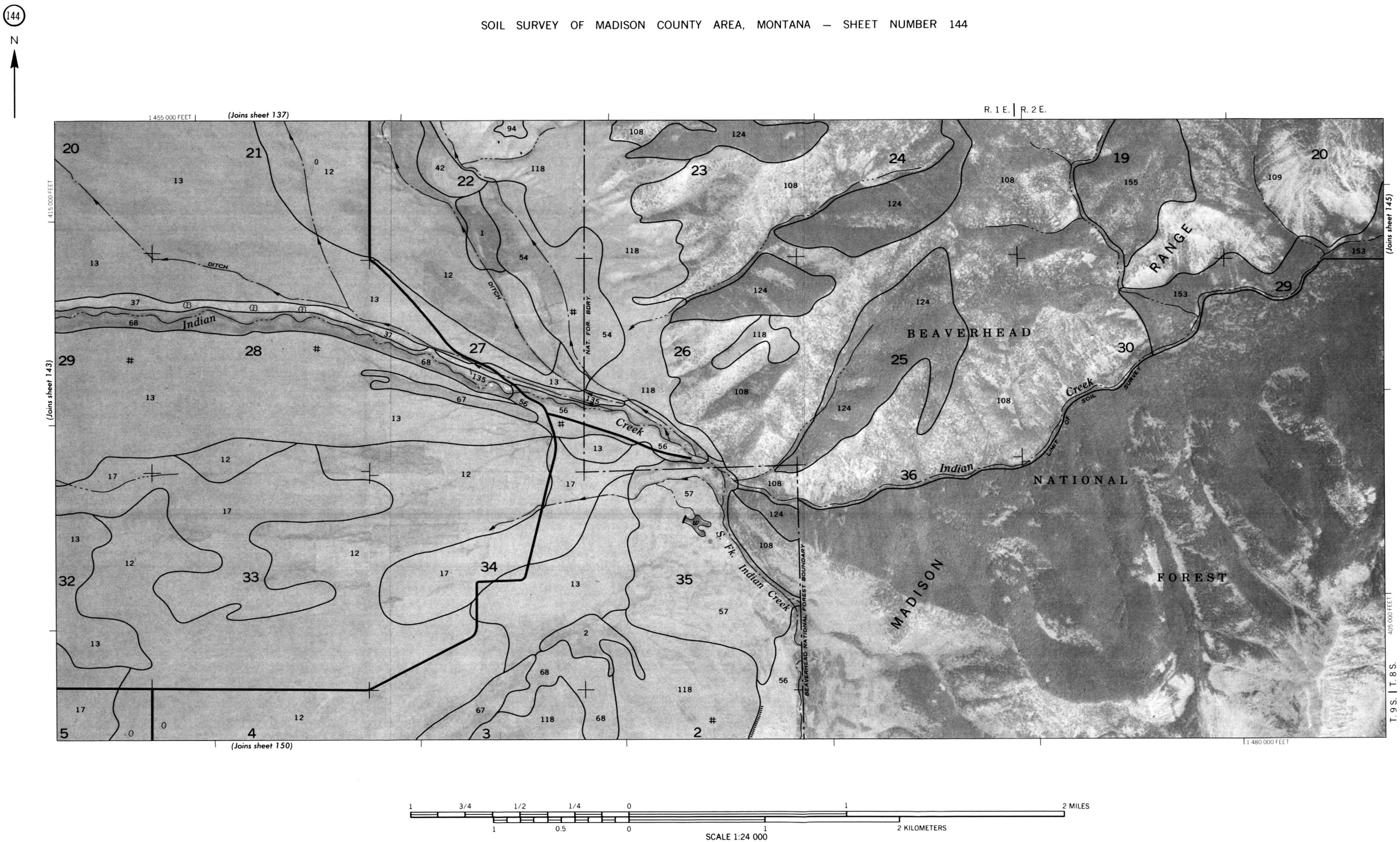
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000



SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 144



N

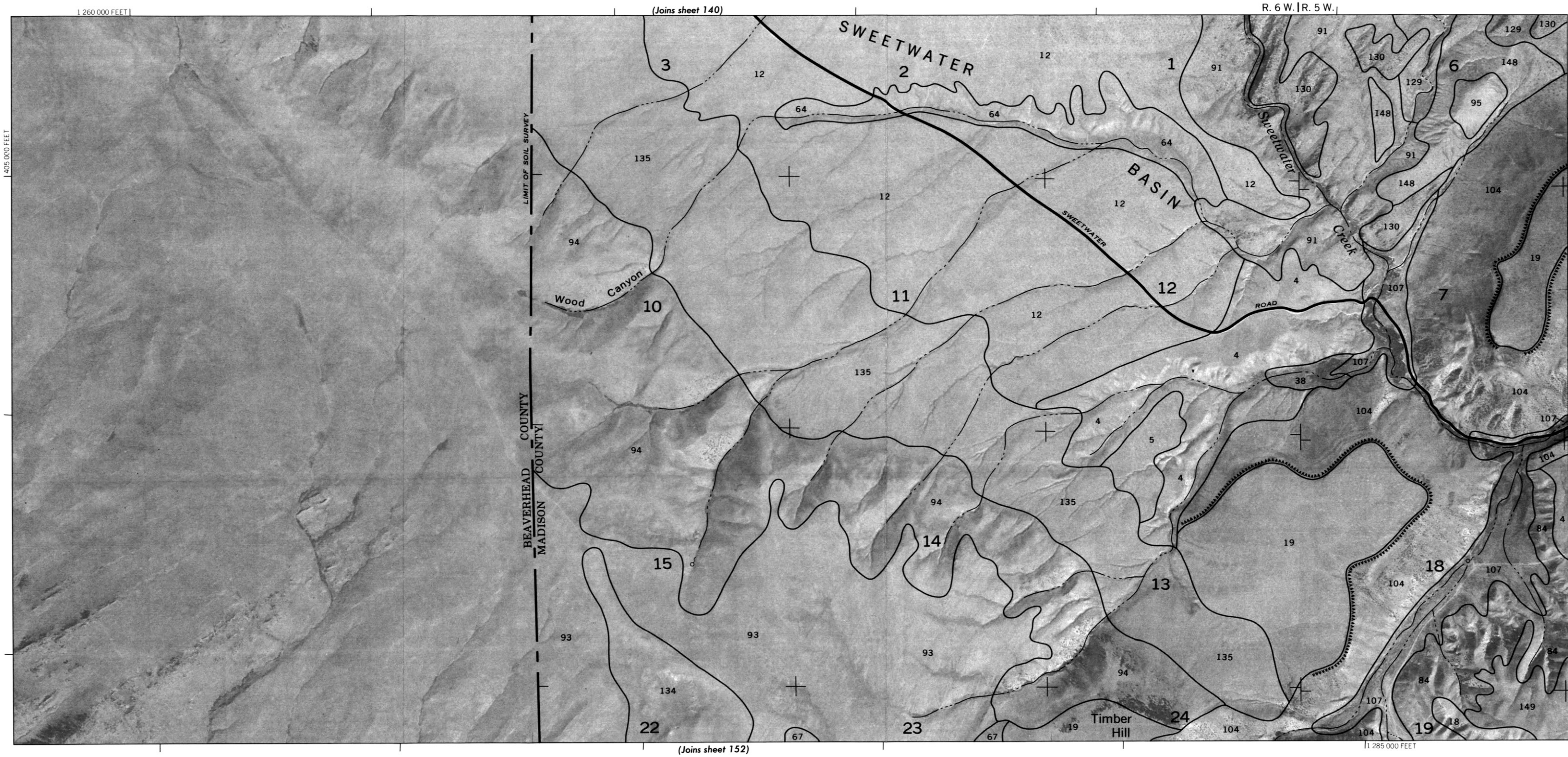
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 146



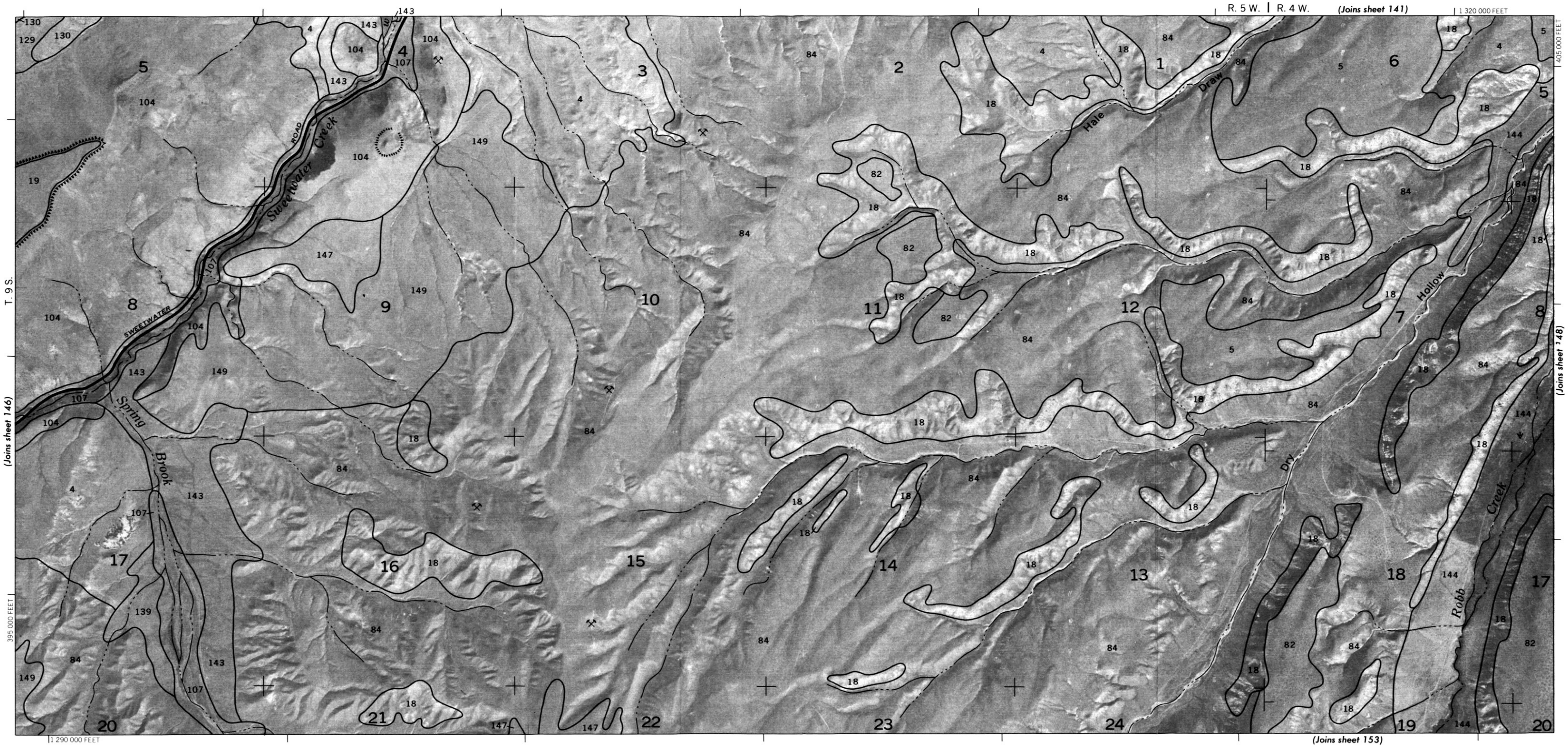
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

147

N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

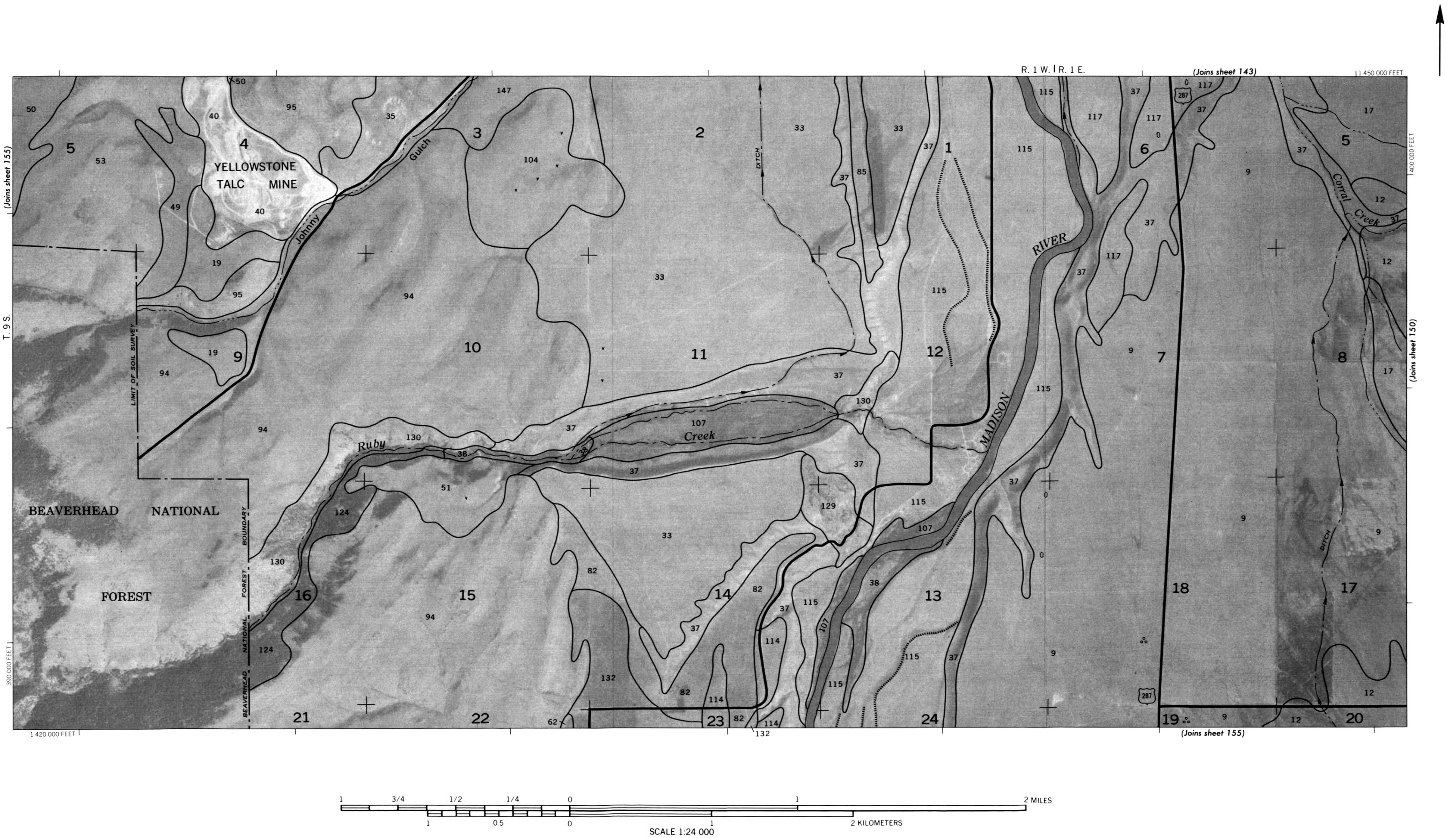
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 148

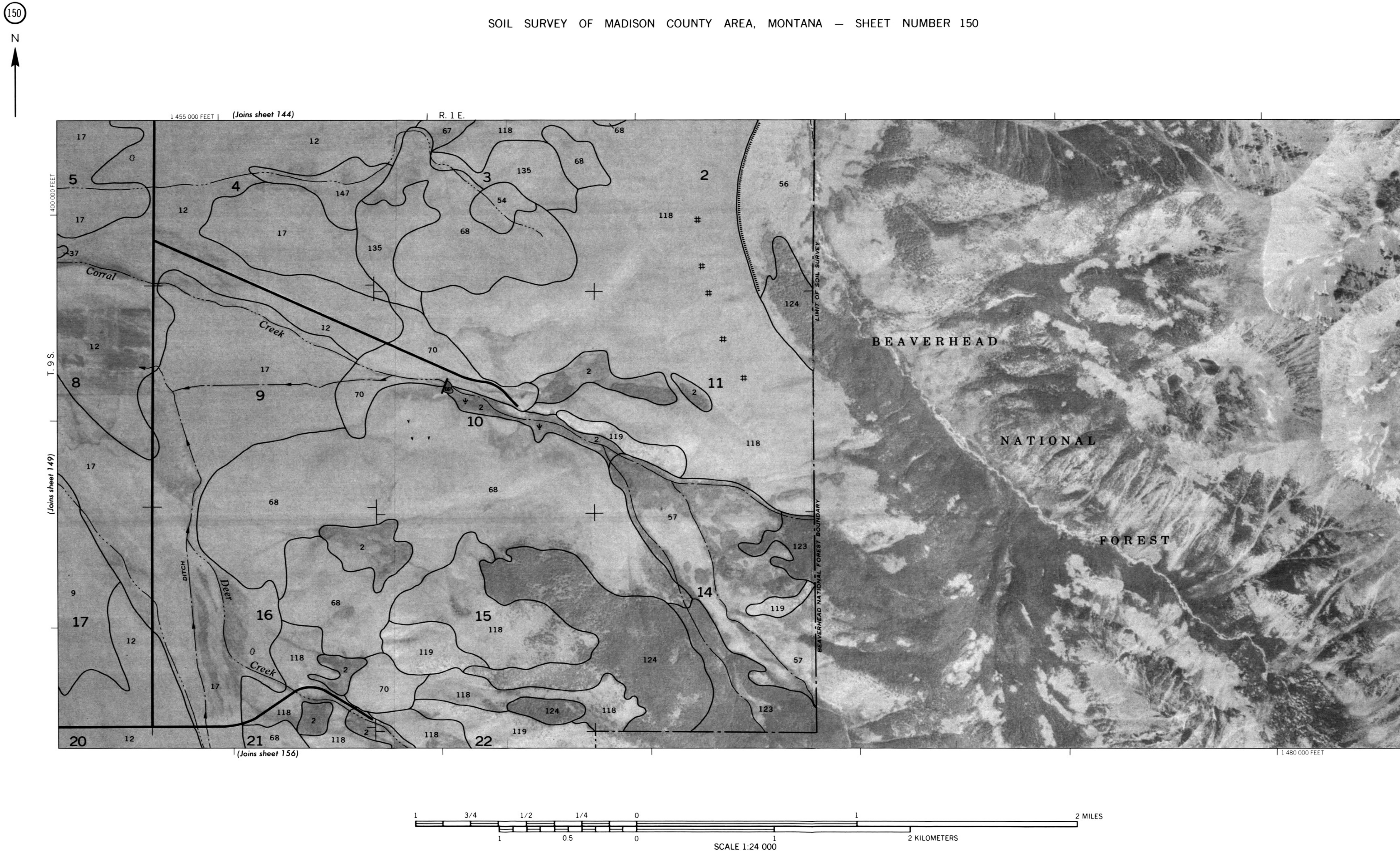
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

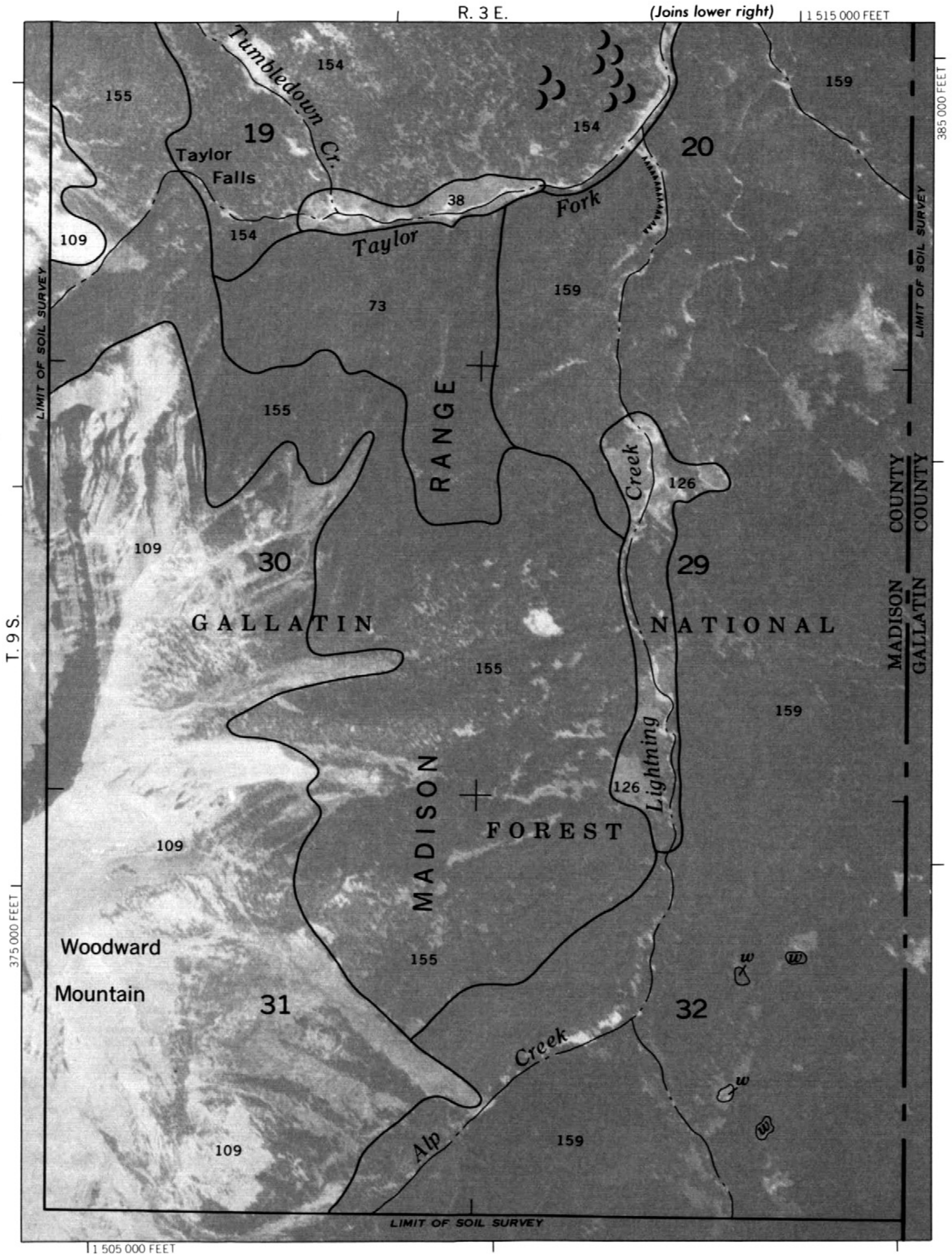
SCALE 1:24 000

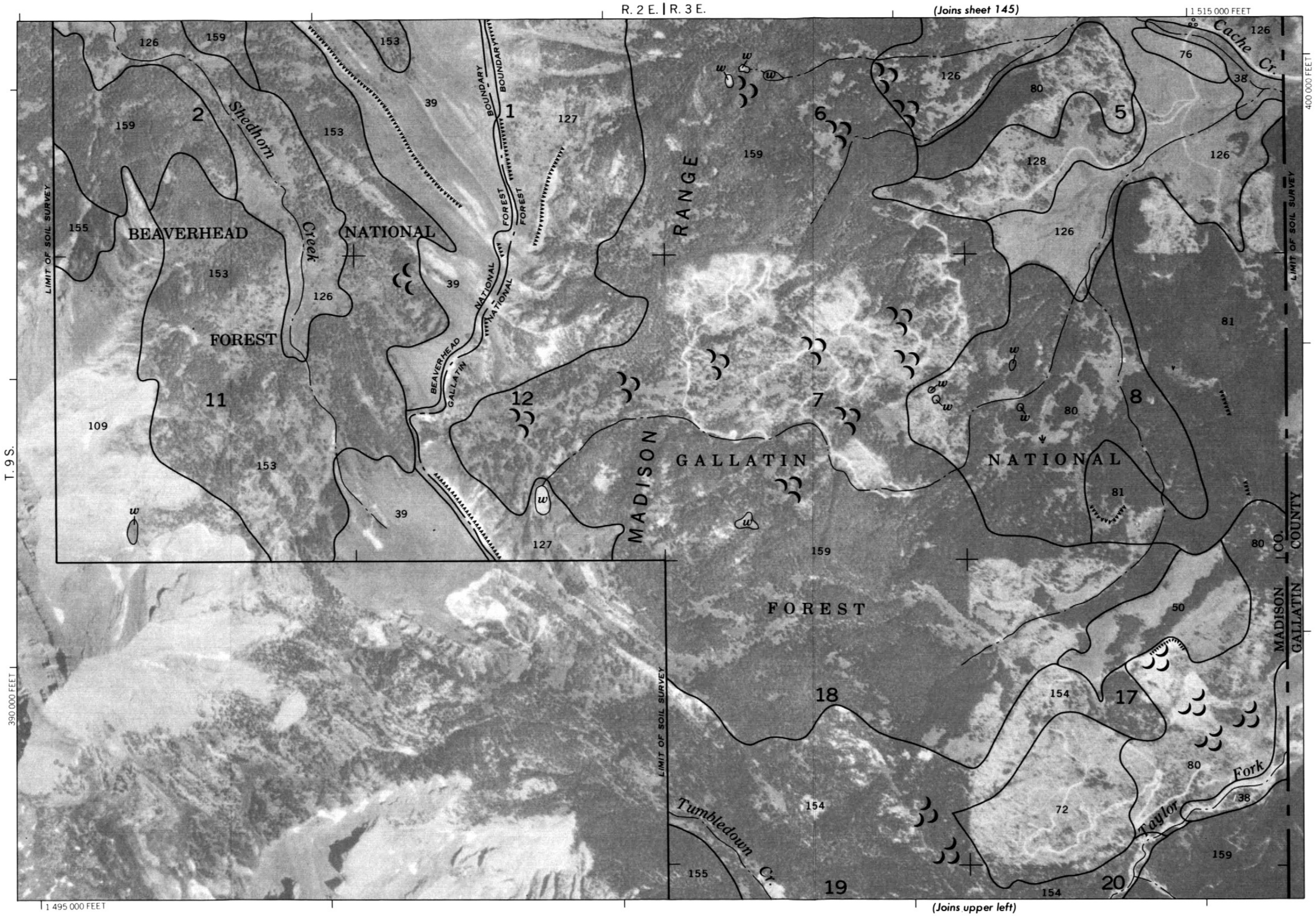

N
R. 1 W. | R. 1 E.
(Joins sheet 143)
1 450 000 FEET
(Joins sheet 155)
(Joins sheet 150)
T. 9 S.
400 000 FEET
390 000 FEET
1 420 000 FEET
(Joins sheet 155)
YELLOWSTONE TALC MINE
Johnny Gulch
Ruby Creek
MADISON RIVER
Corral Creek
DITCH
LIMIT OF SOIL SURVEY
BEAVERHEAD NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST BOUNDARY
287
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 150



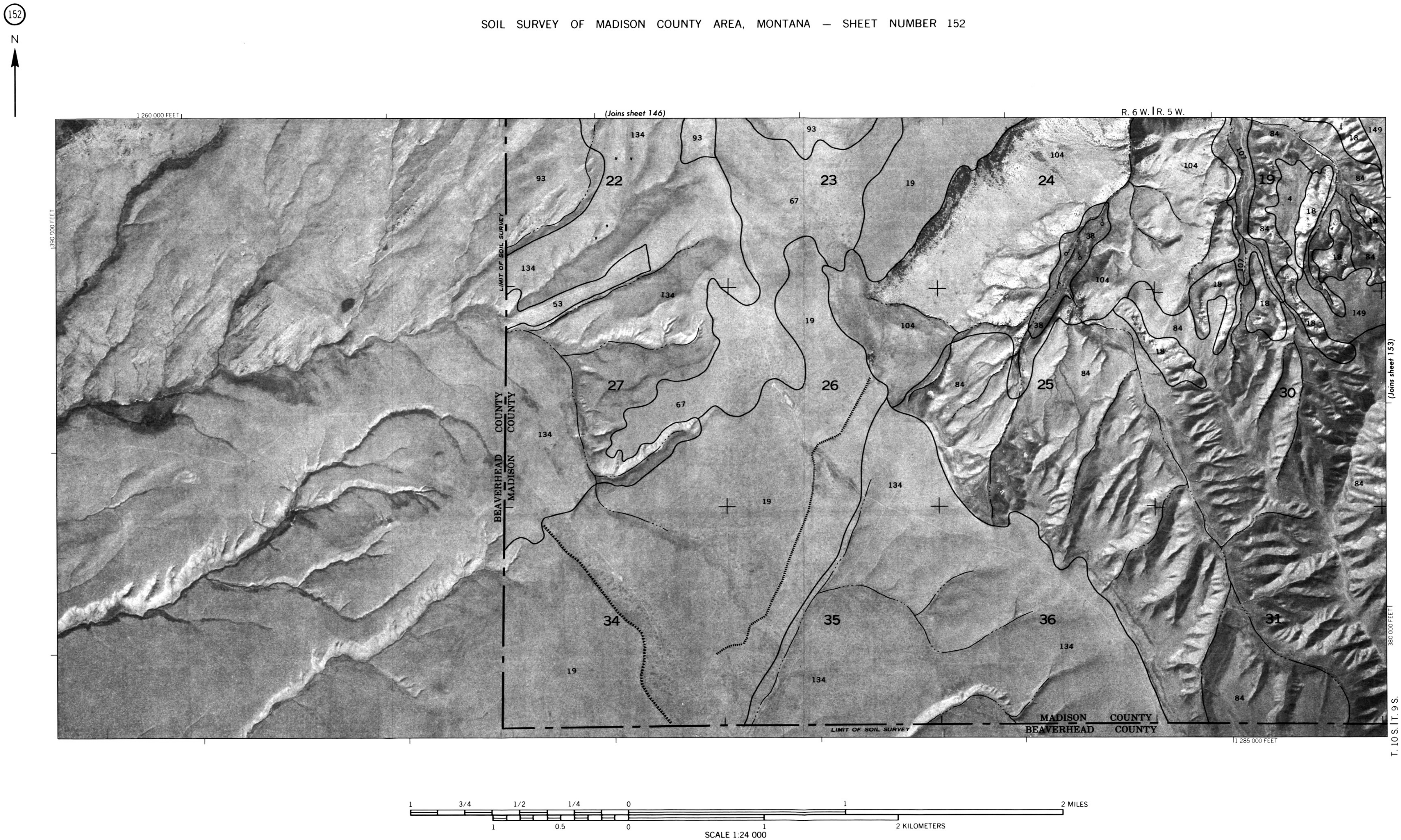
N

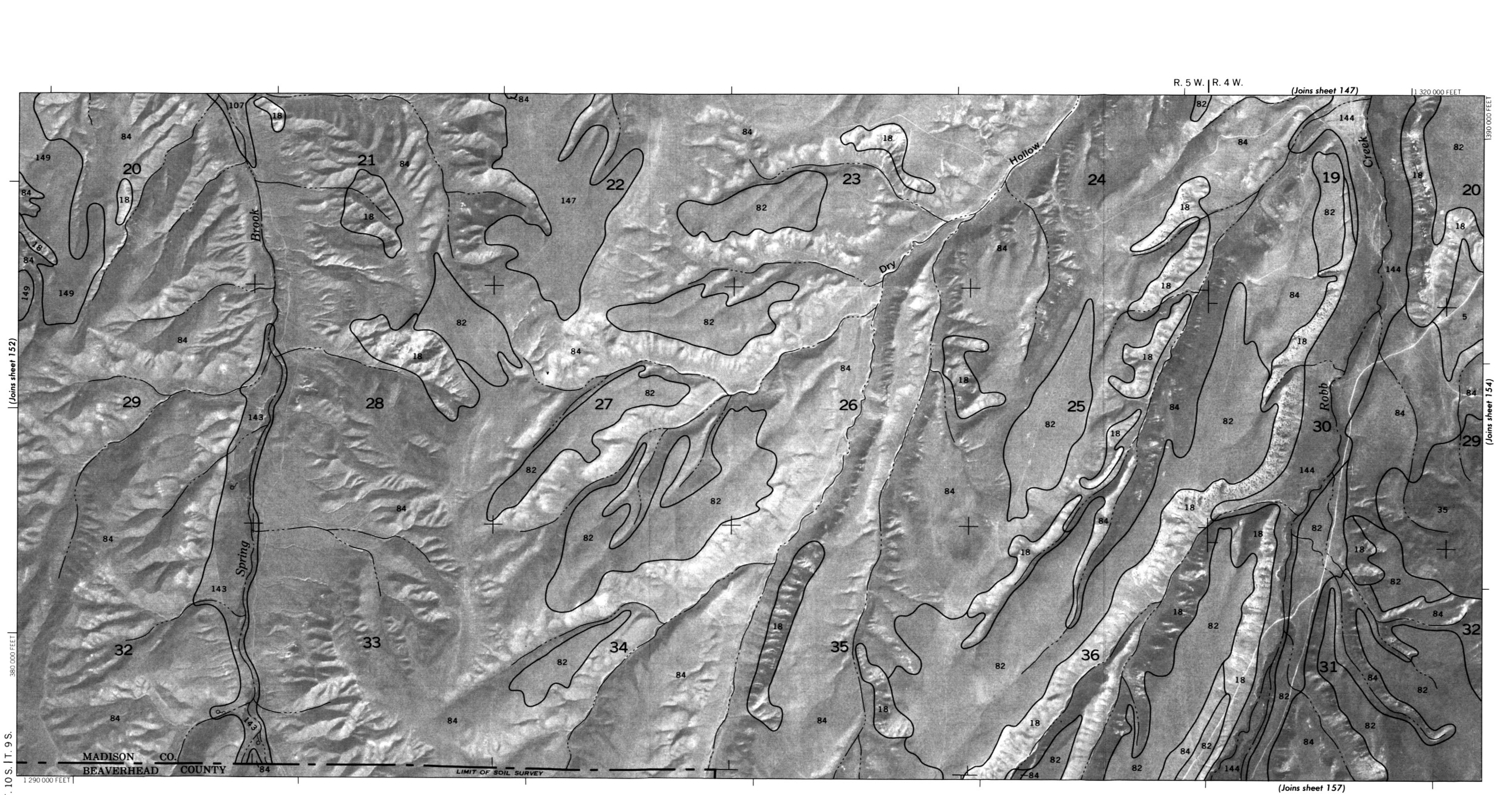




1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 152



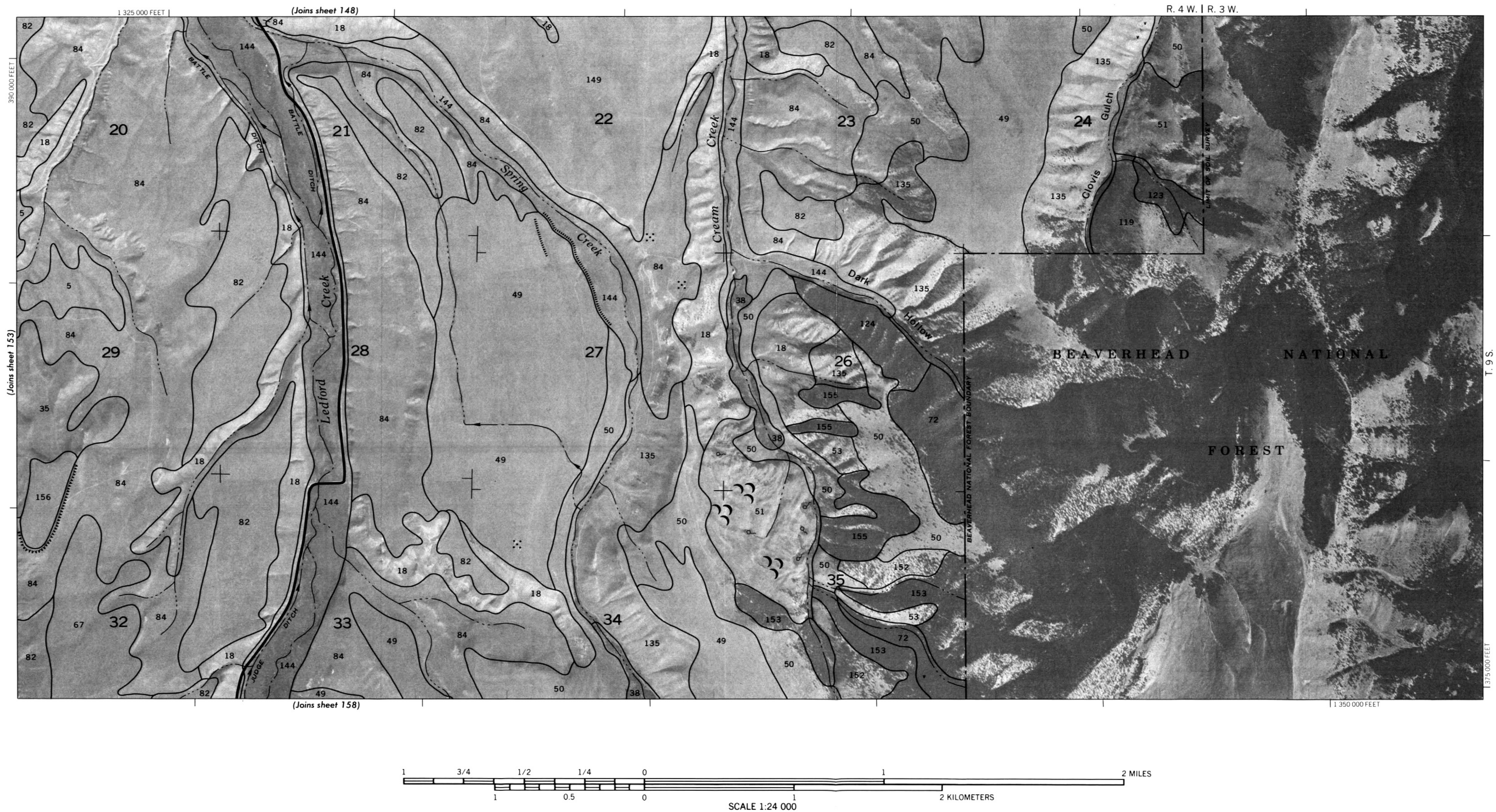


1 3/4 1/2 1/4 0 1 2 MILES

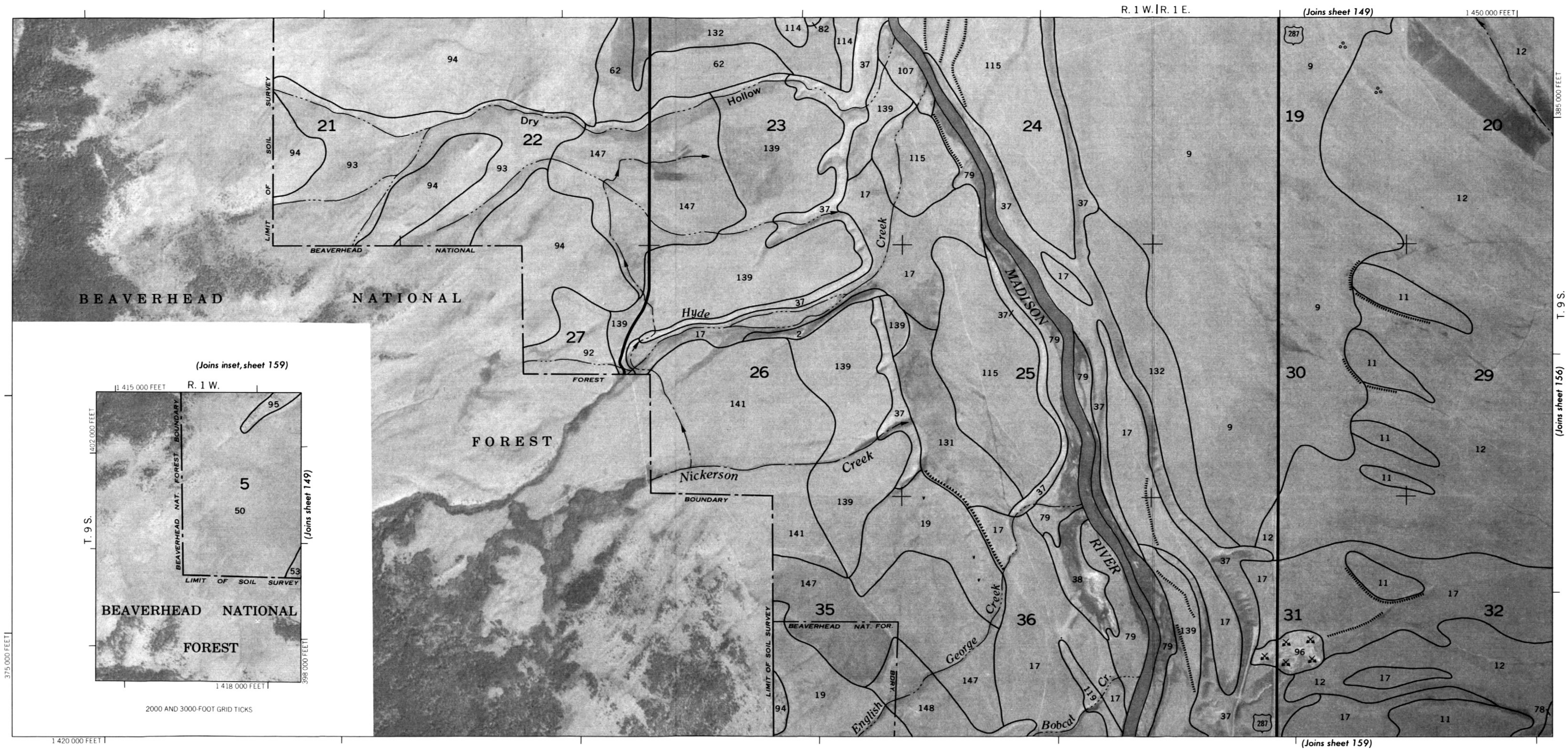
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 154



N



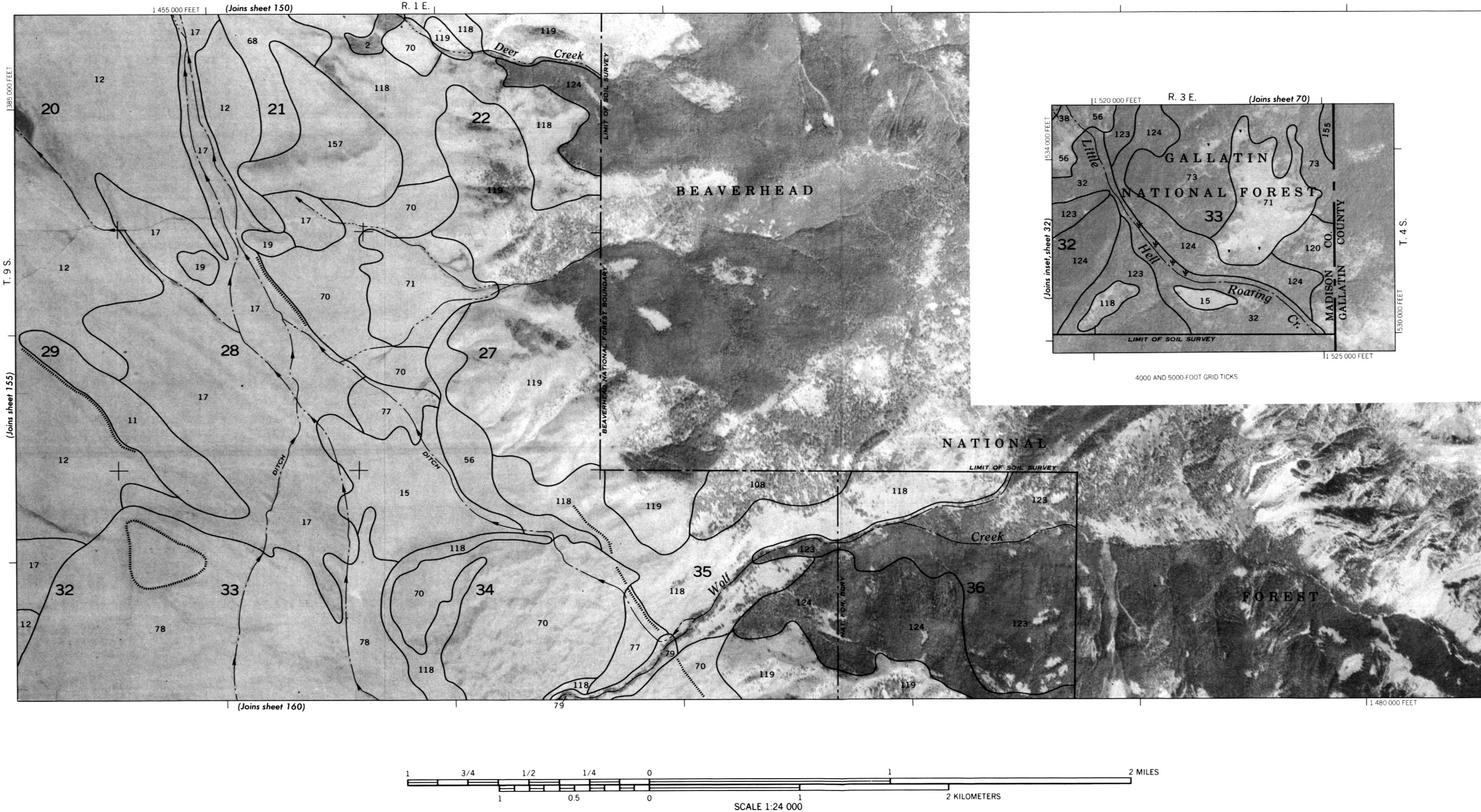
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

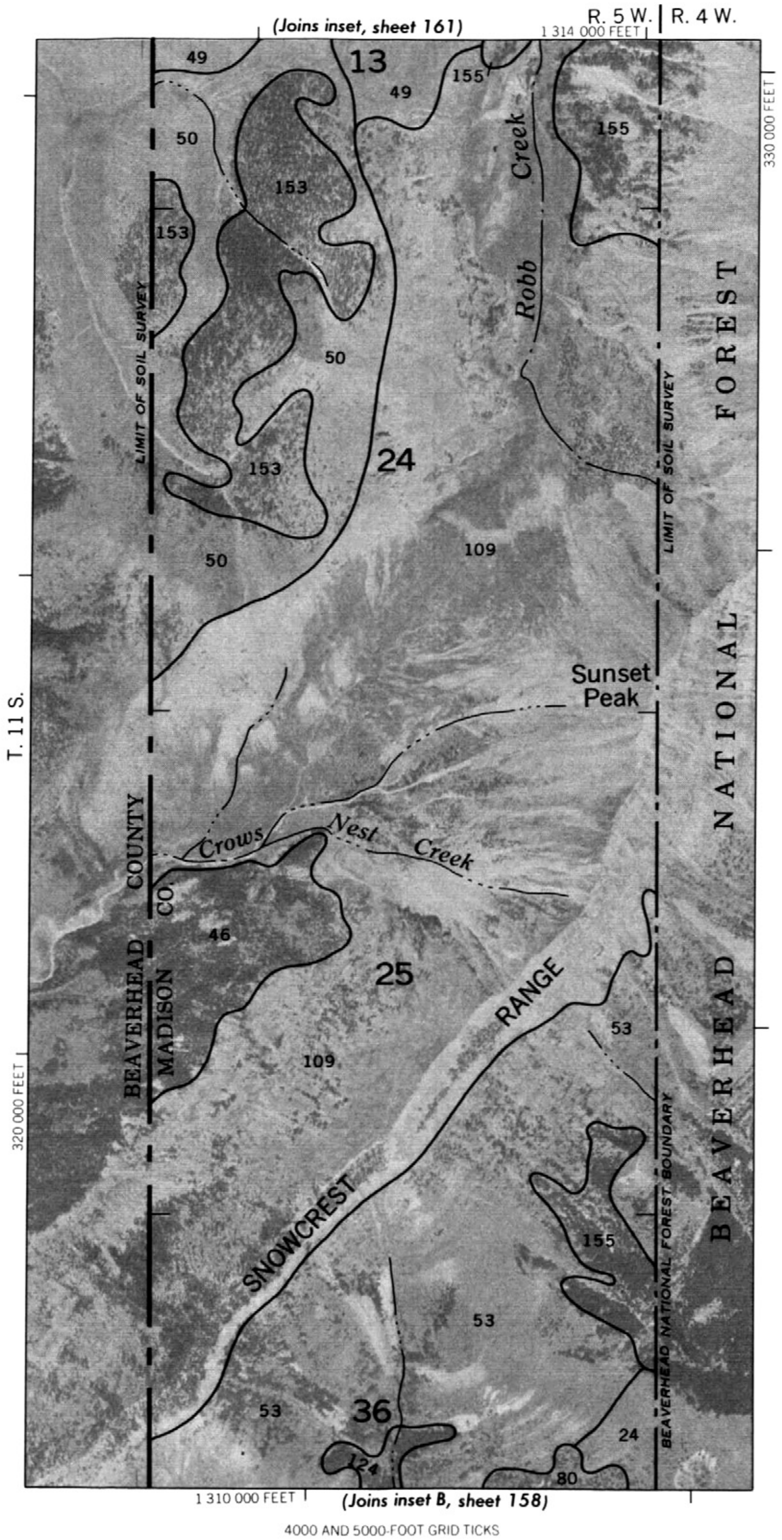
(156)

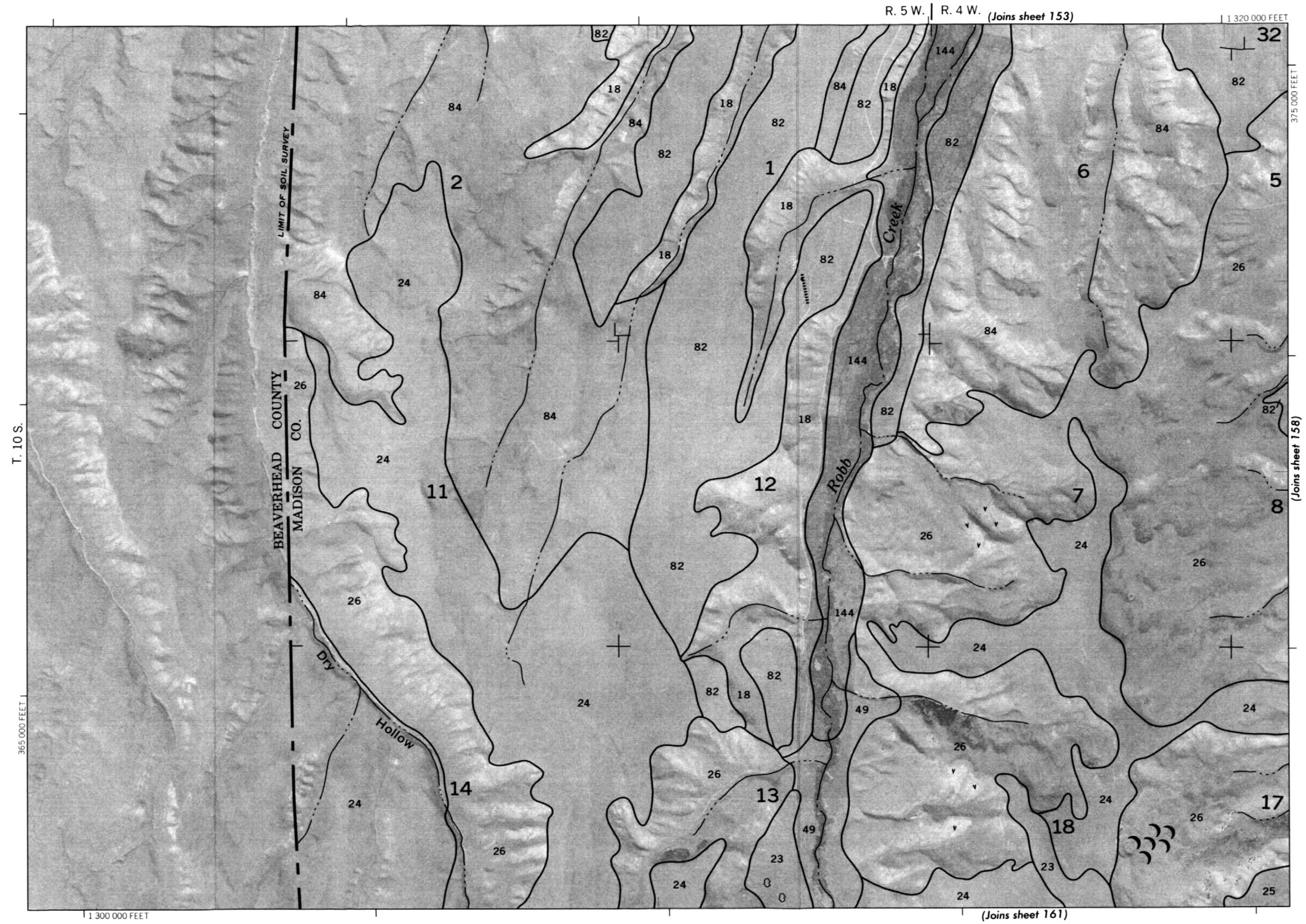
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 156



SCALE 1:24 000

N





1 3/4 1/2 1/4 0 1 2 MILES

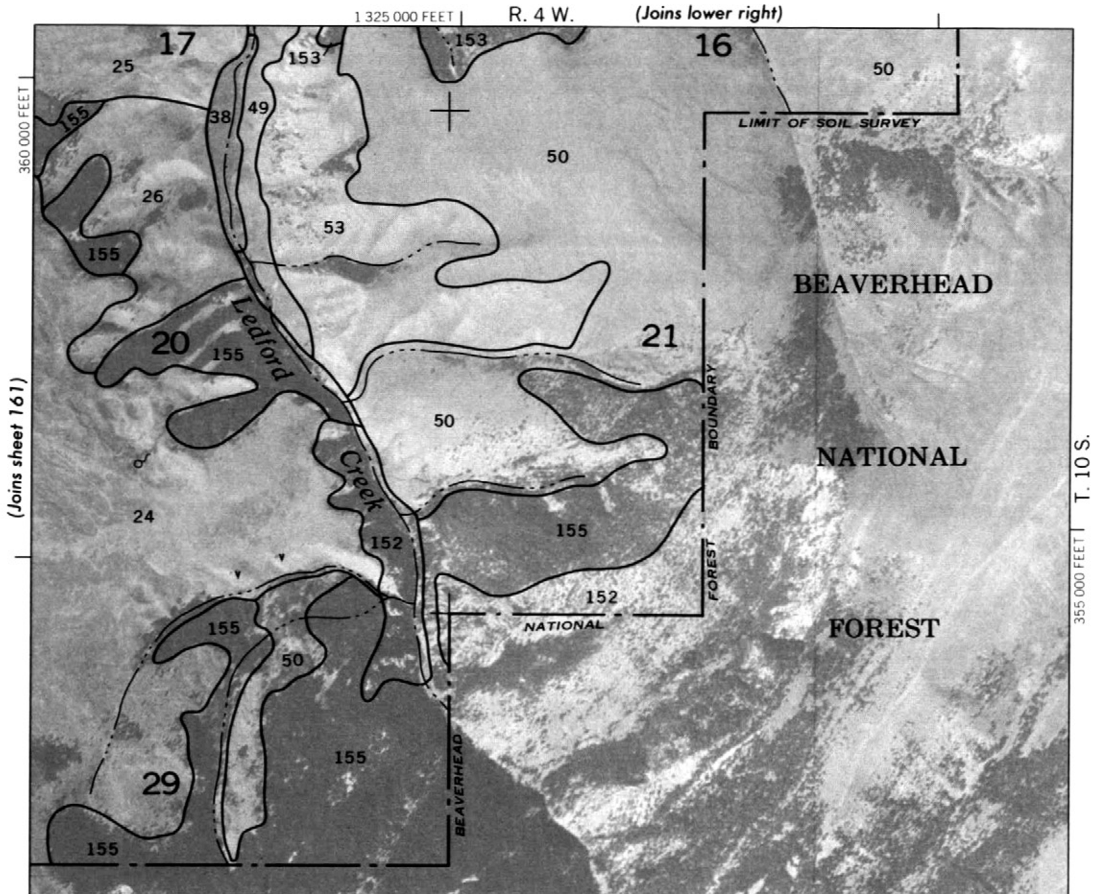
1 0.5 0 1 2 KILOMETERS

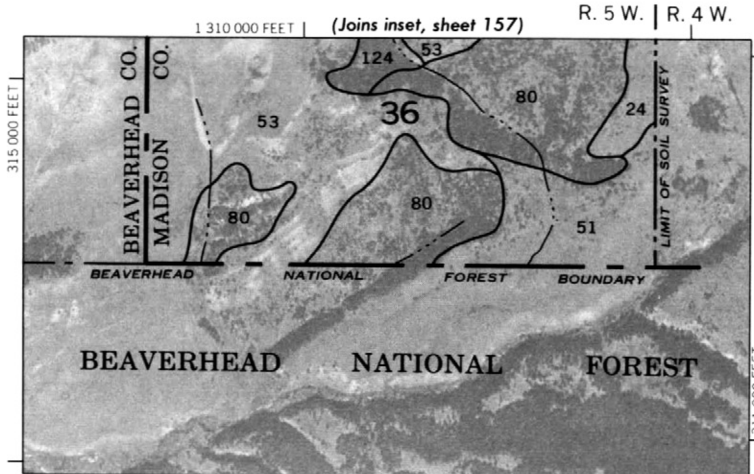
SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 158

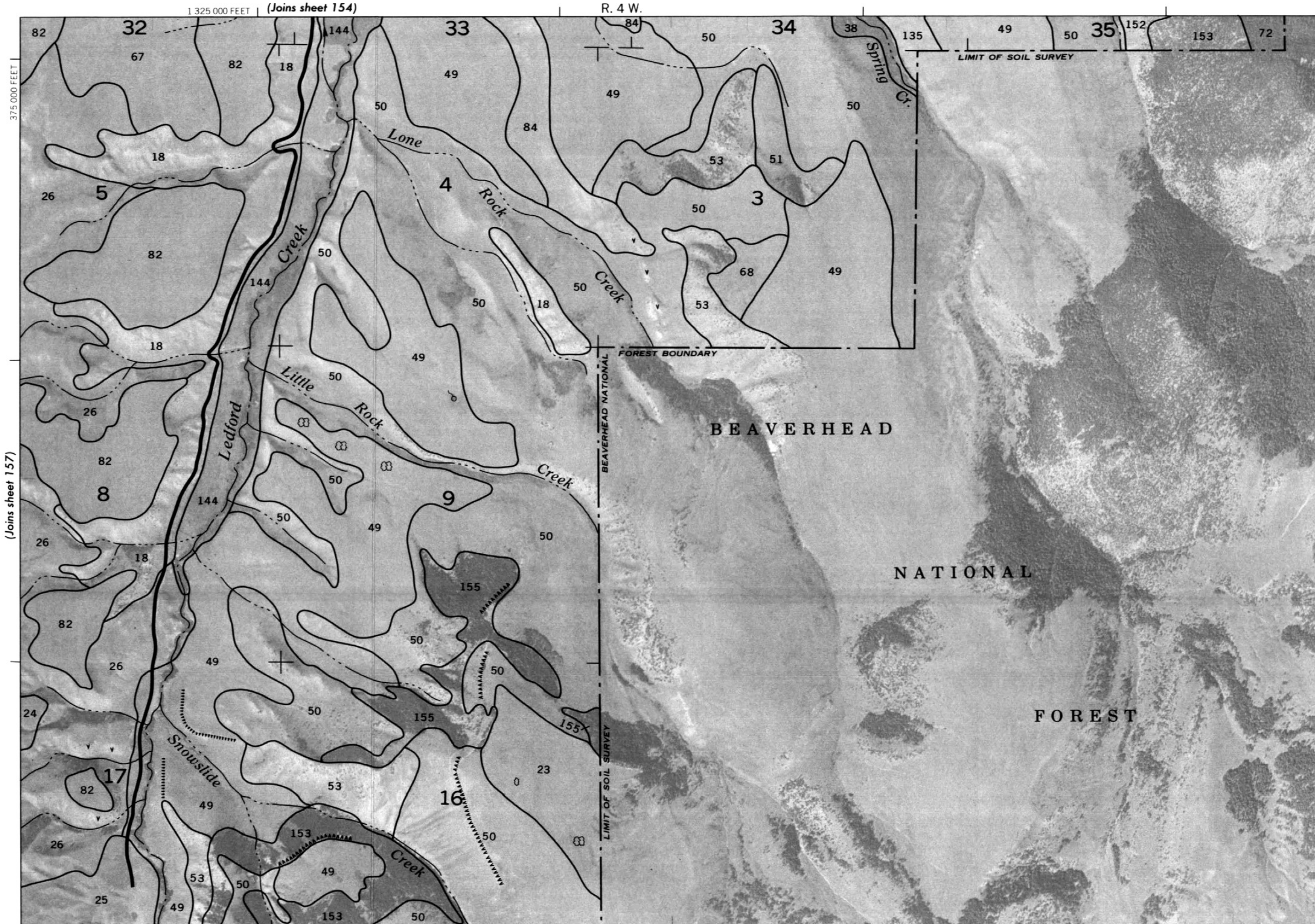
INSET A





INSET B

4000-FOOT GRID TICKS

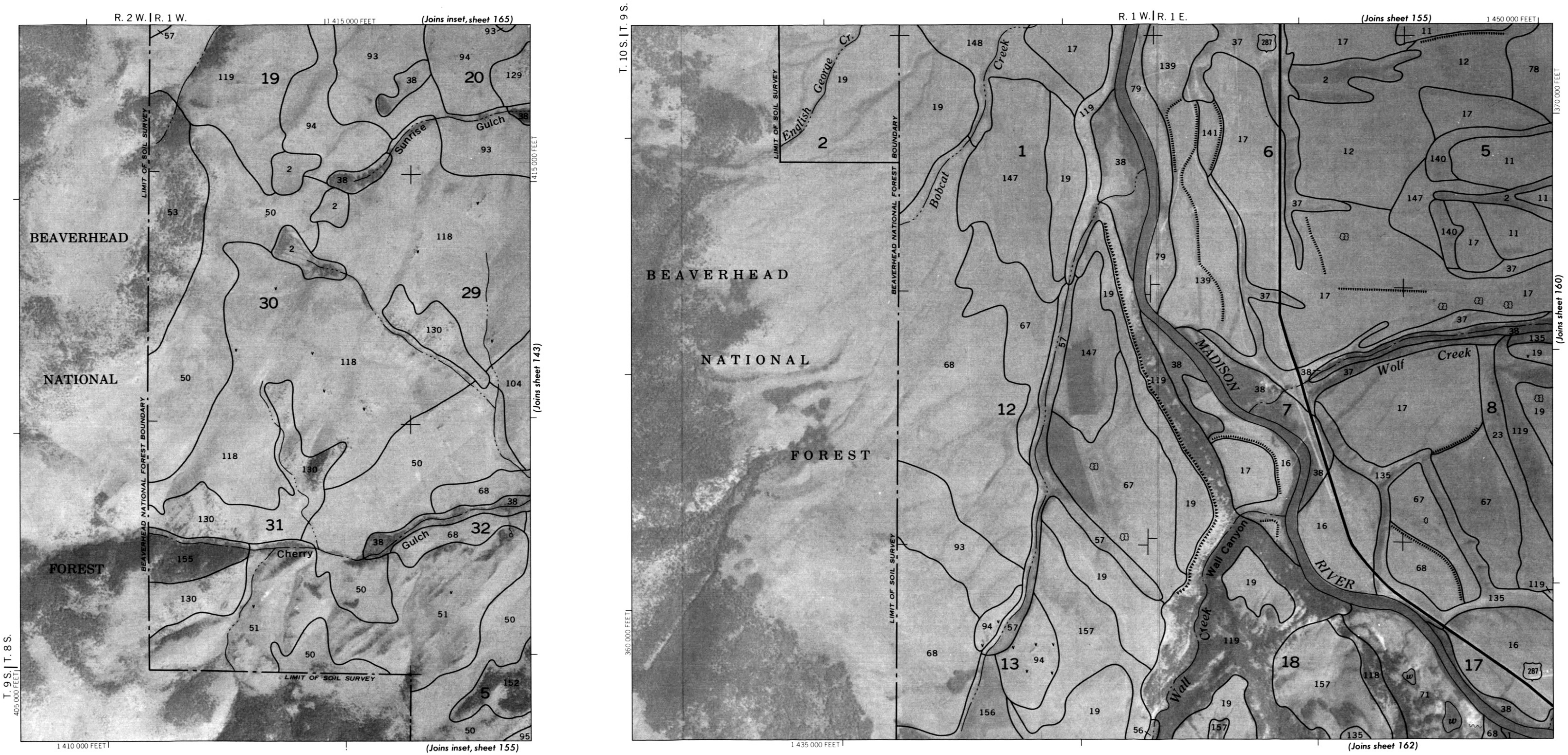


1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

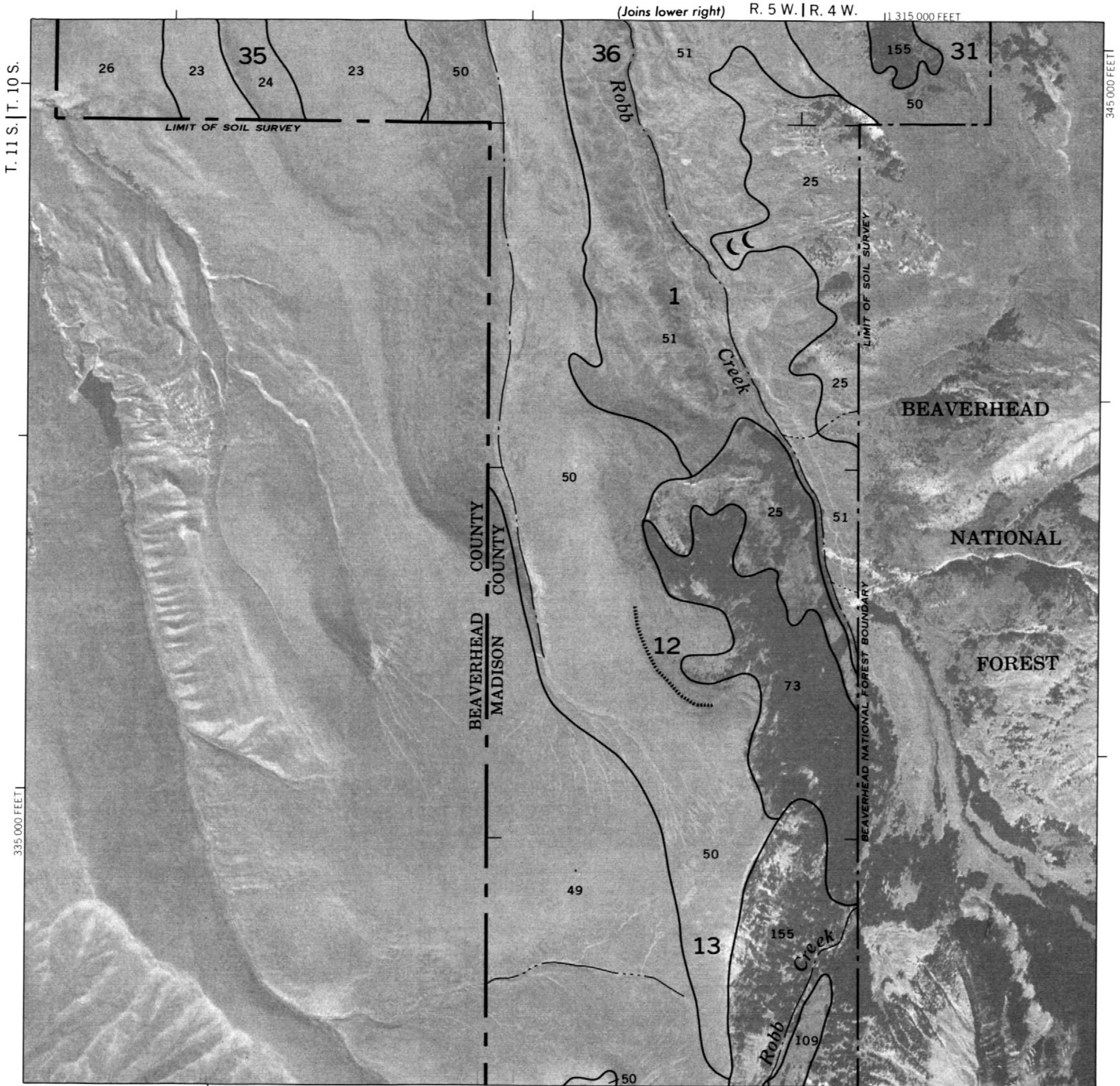
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 160

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

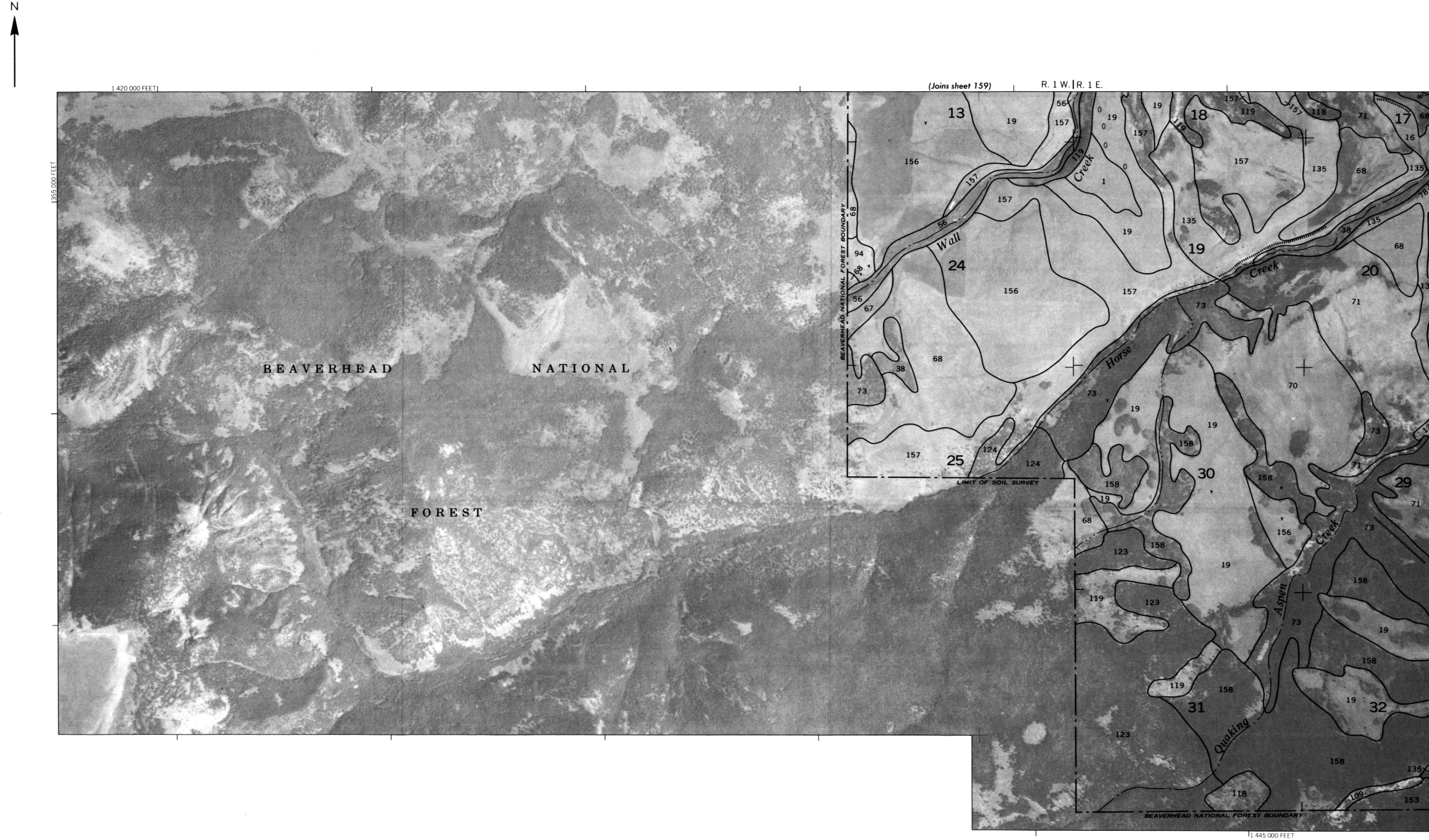


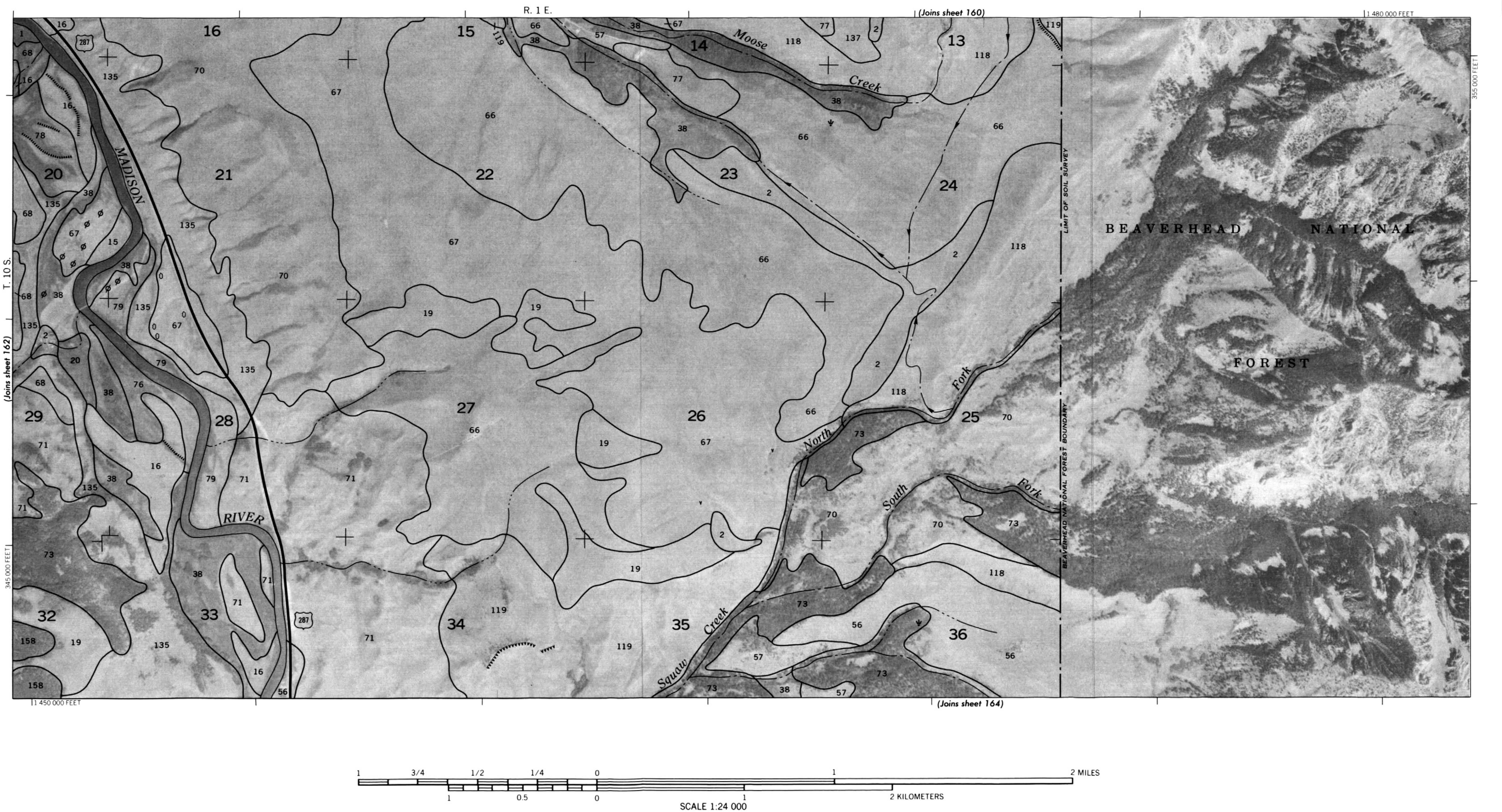
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

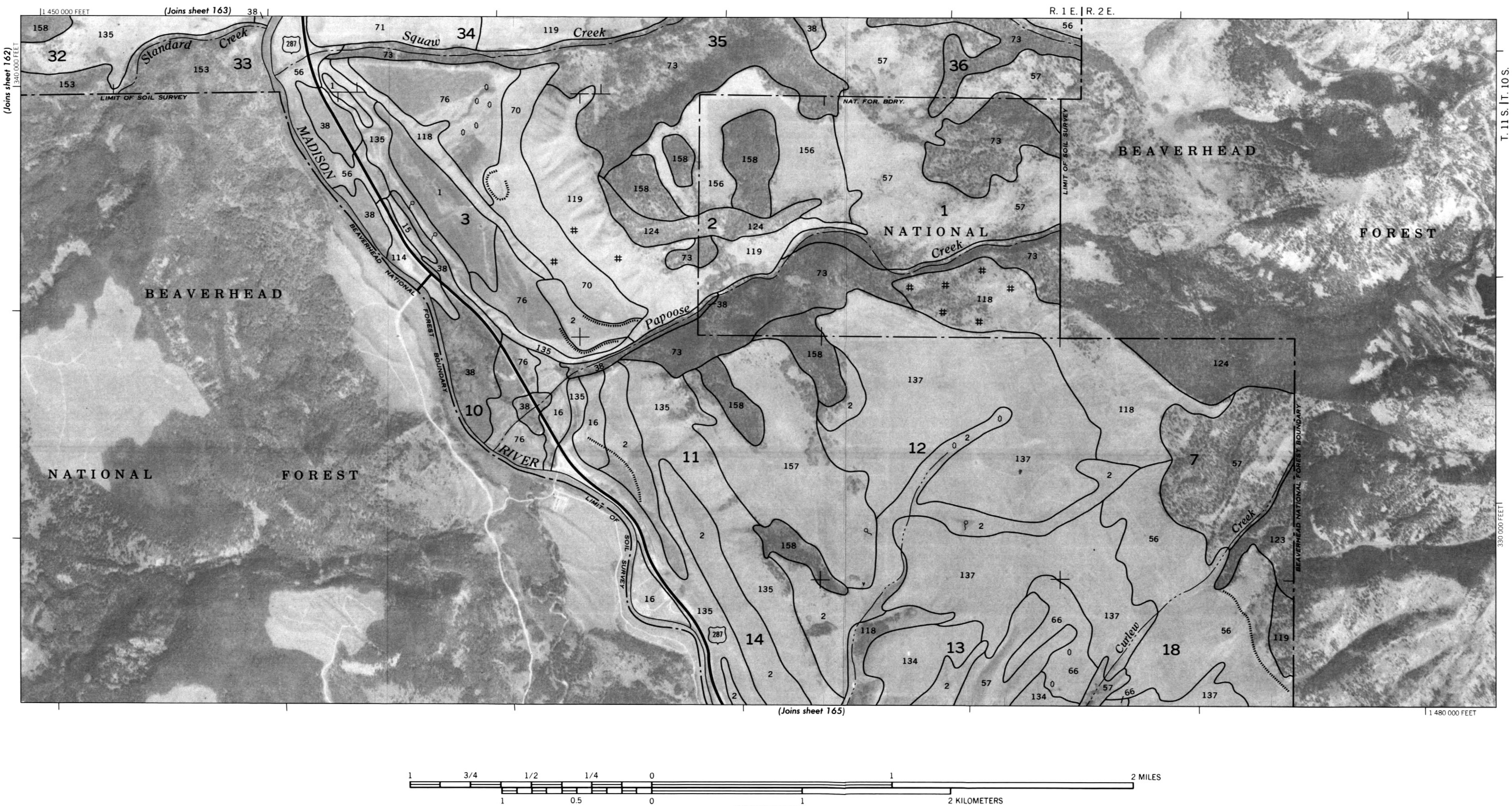
SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 162



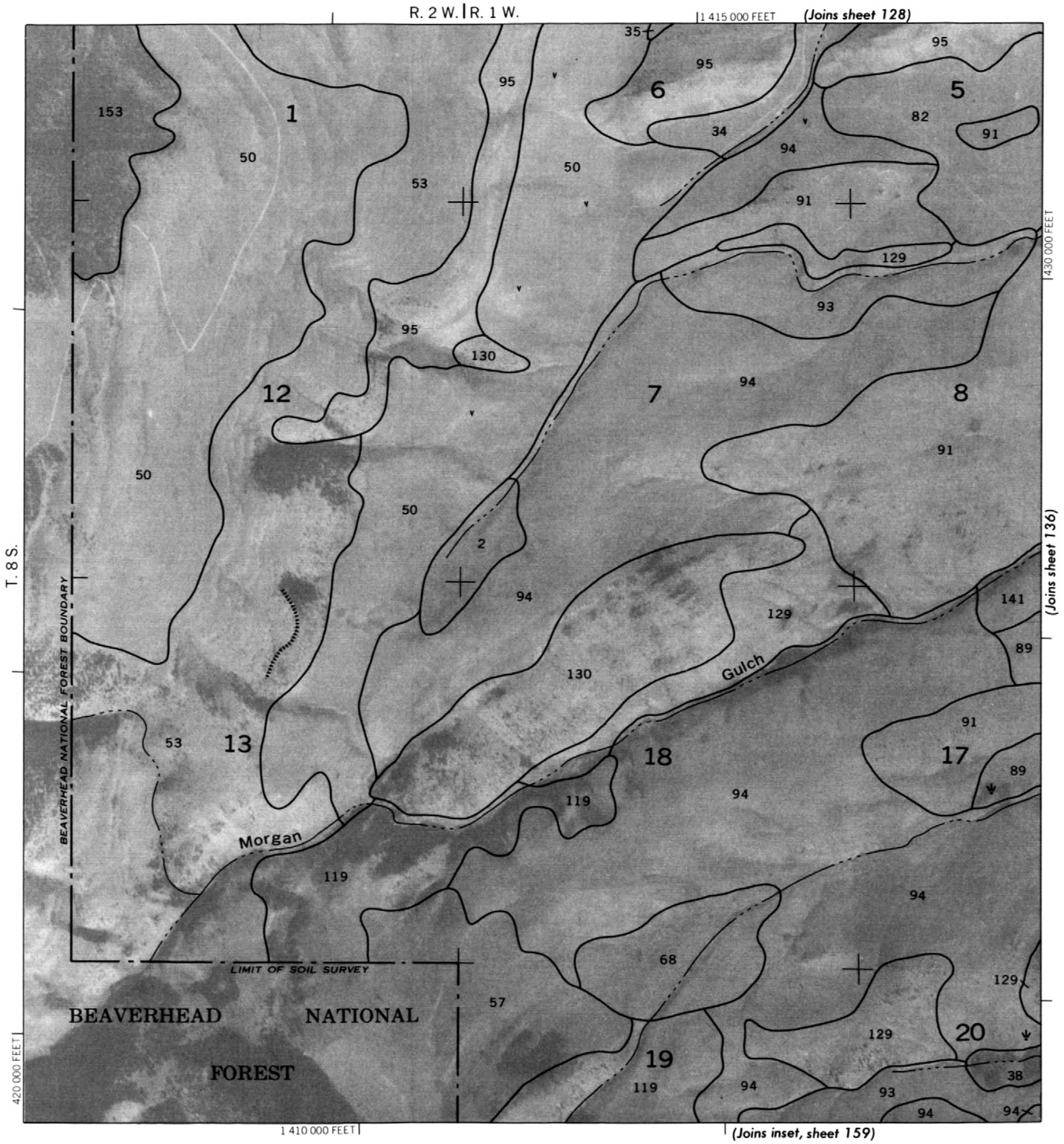

N
R. 1 E.
(Joins sheet 160)
1 480 000 FEET
355 000 FEET
T. 10 S.
(Joins sheet 162)
345 000 FEET
1 450 000 FEET
(Joins sheet 164)
MADISON
RIVER
Moose
Creek
North
Fork
South
Fork
Squaw
Creek
LIMIT OF SOIL SURVEY
BEAVERHEAD NATIONAL FOREST BOUNDARY
BEAVERHEAD NATIONAL FOREST
287
1
3/4
1/2
1/4
0
1
2 MILES
1
0.5
0
1
2 KILOMETERS
SCALE 1:24 000

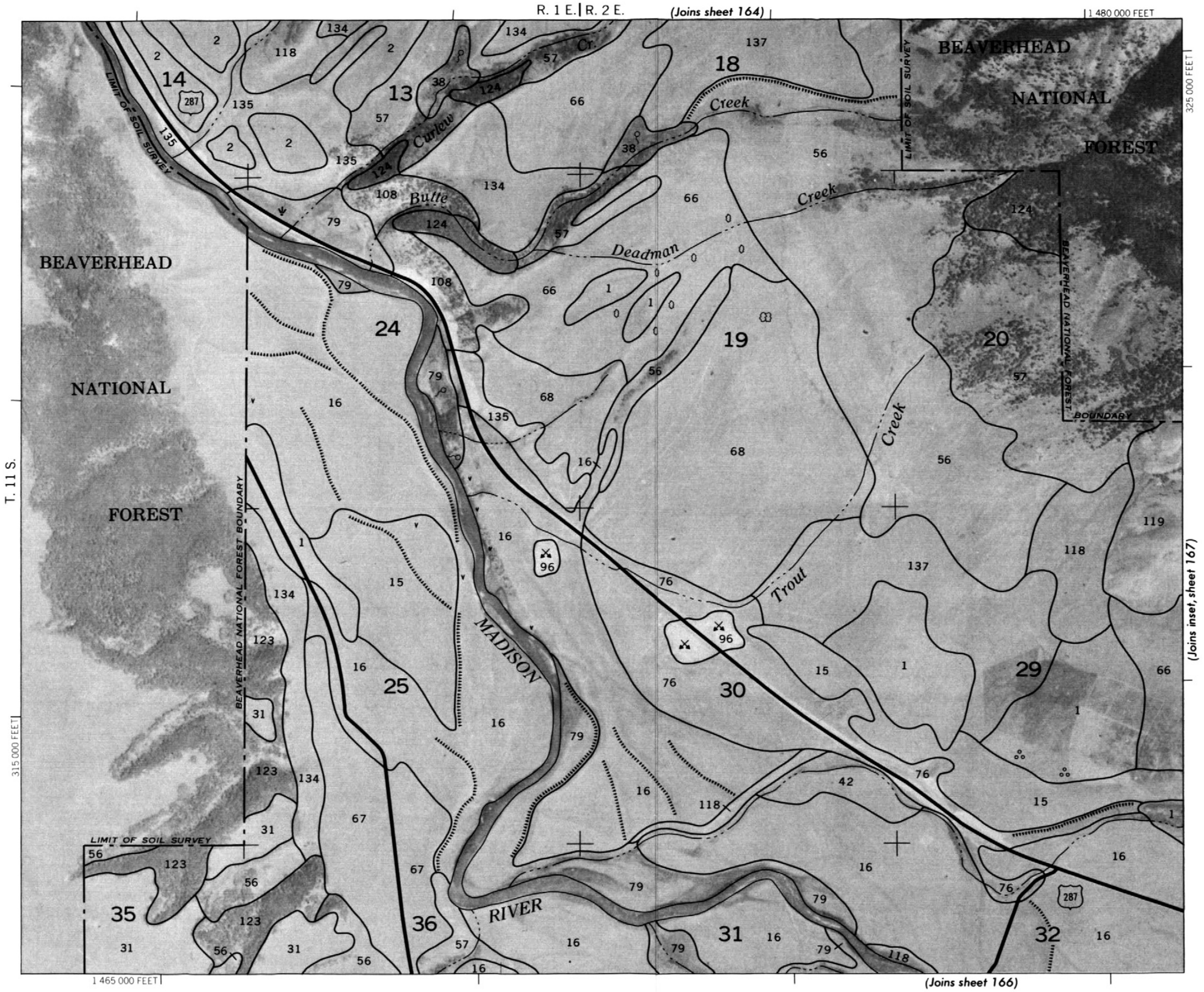
N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 164



N





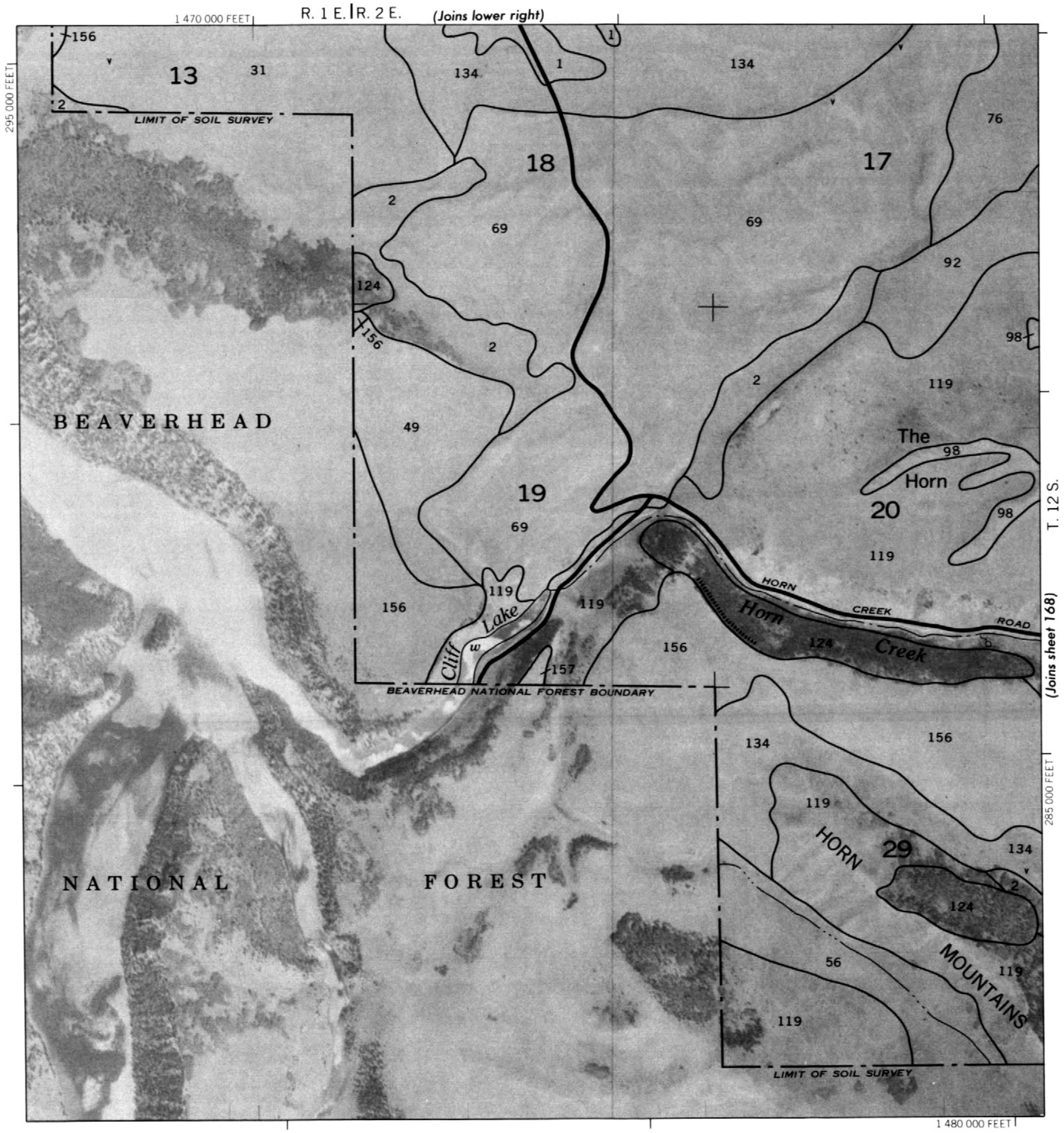
1 3/4 1/2 1/4 0 1 2 MILES

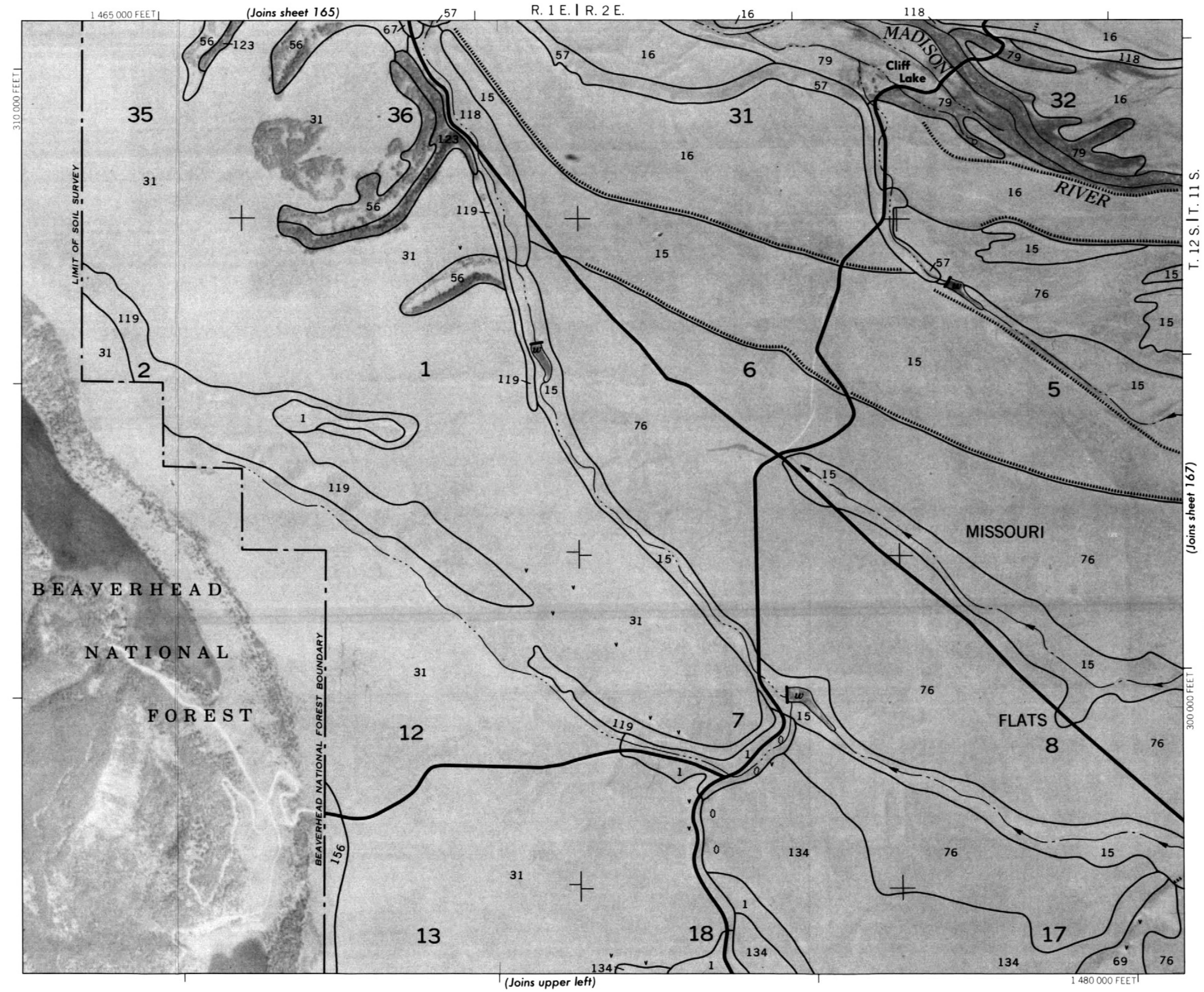
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 166



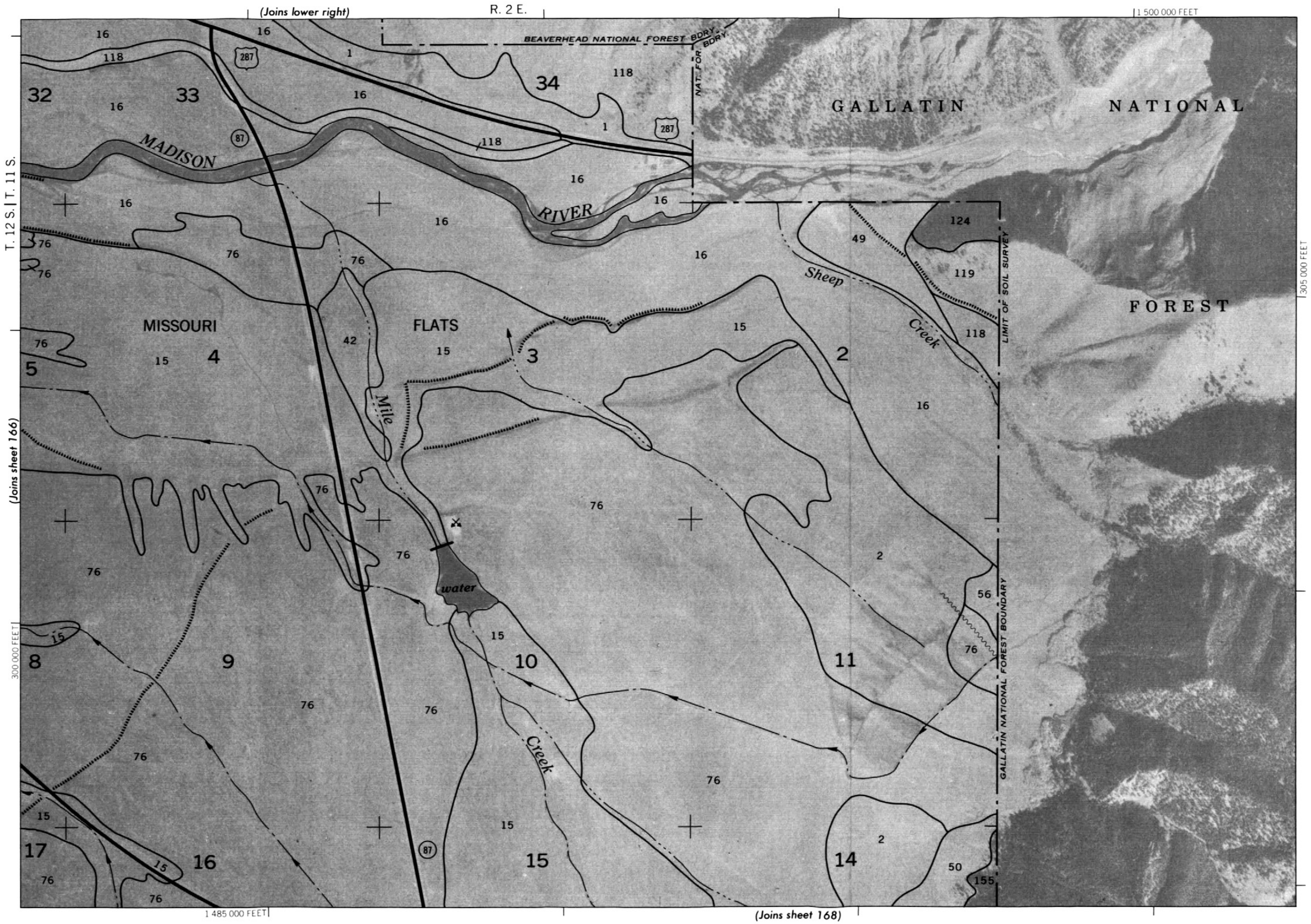


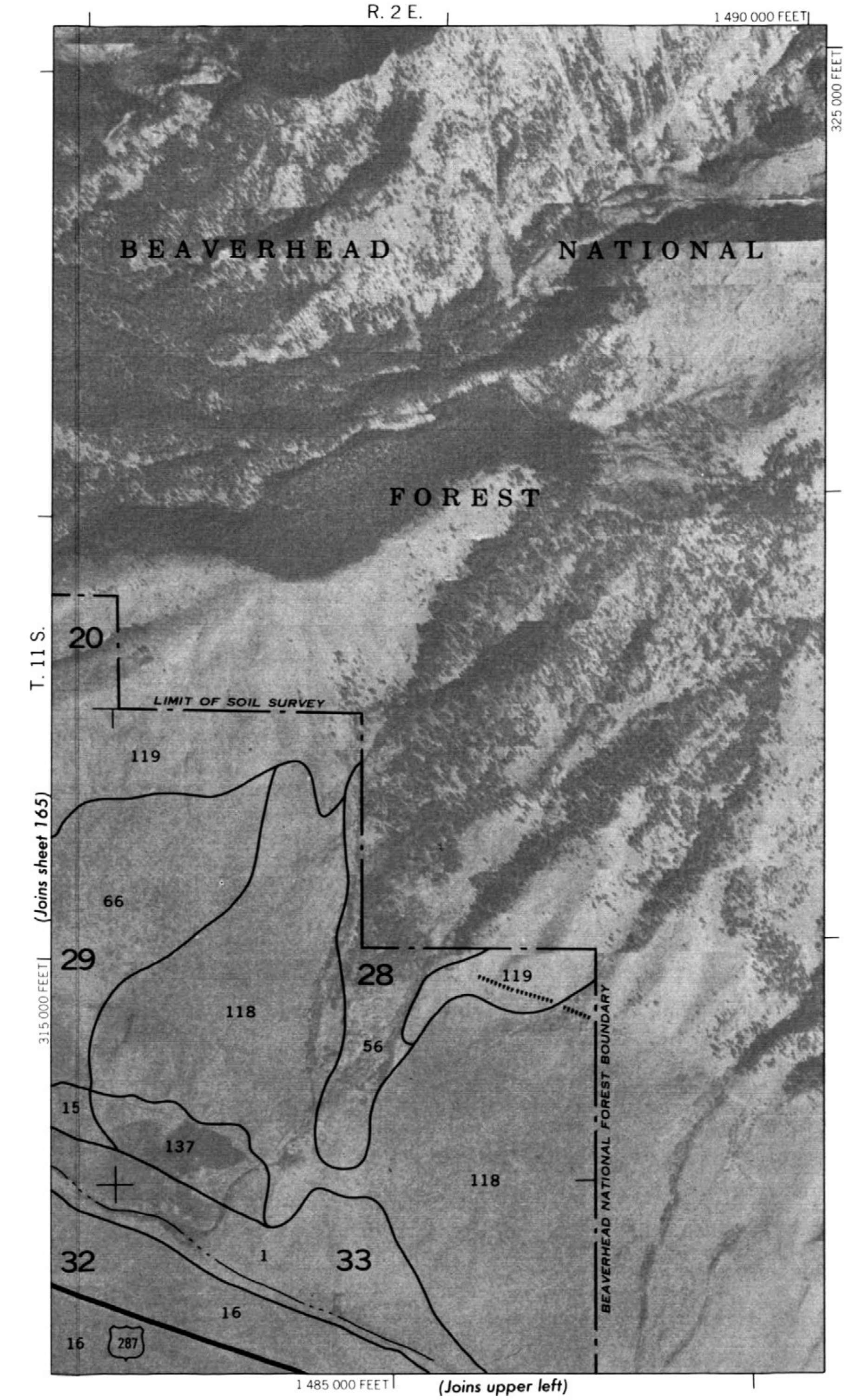
1 | 3/4 | 1/2 | 1/4 | 0 | 1 | 2 MILES

1 | 0.5 | 0 | 1 | 2 KILOMETERS

SCALE 1:24 000

N





4000 AND 5000-FOOT GRID TICKS

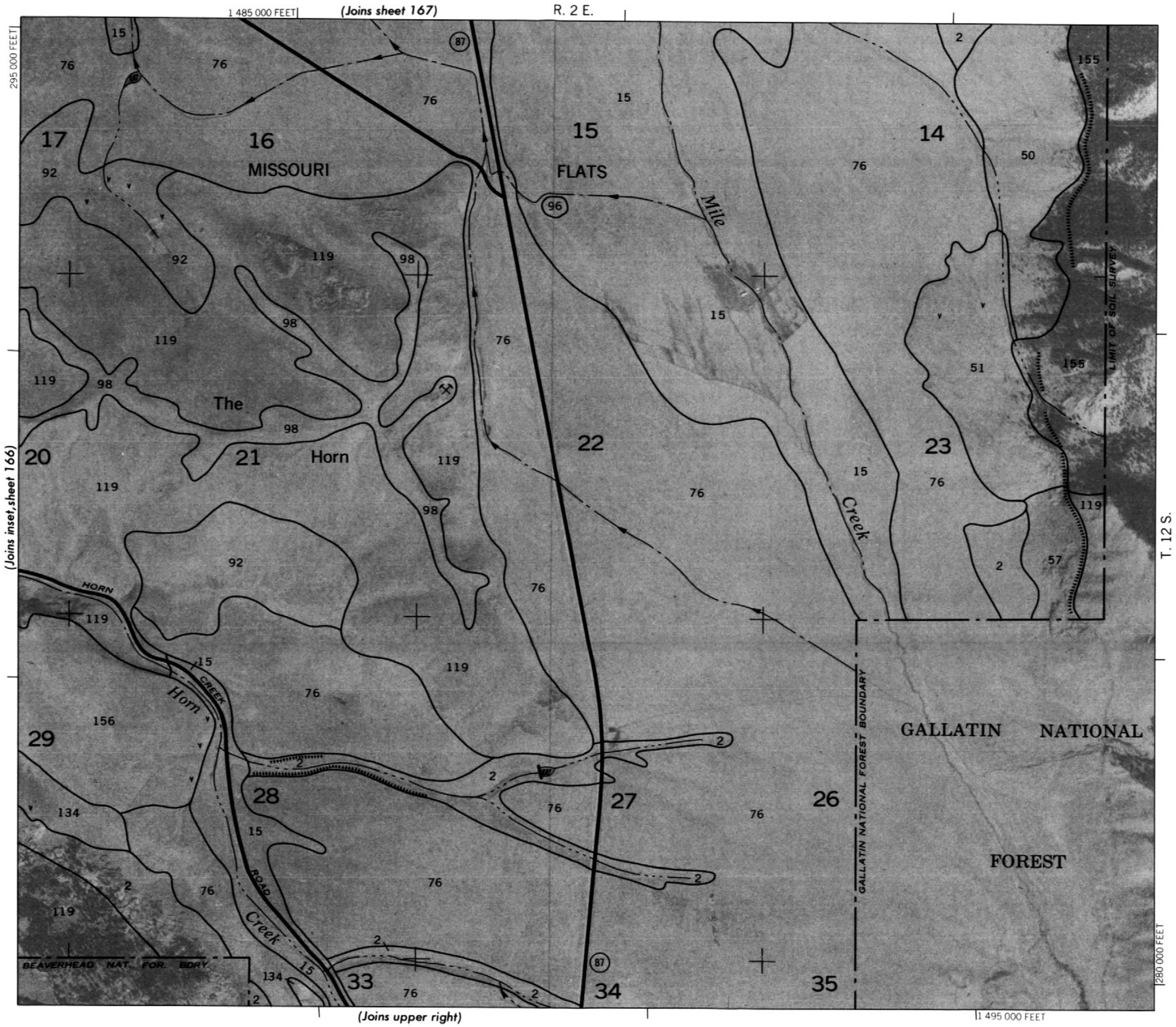
1 3/4 1/2 1/4 0 1 2 MILES

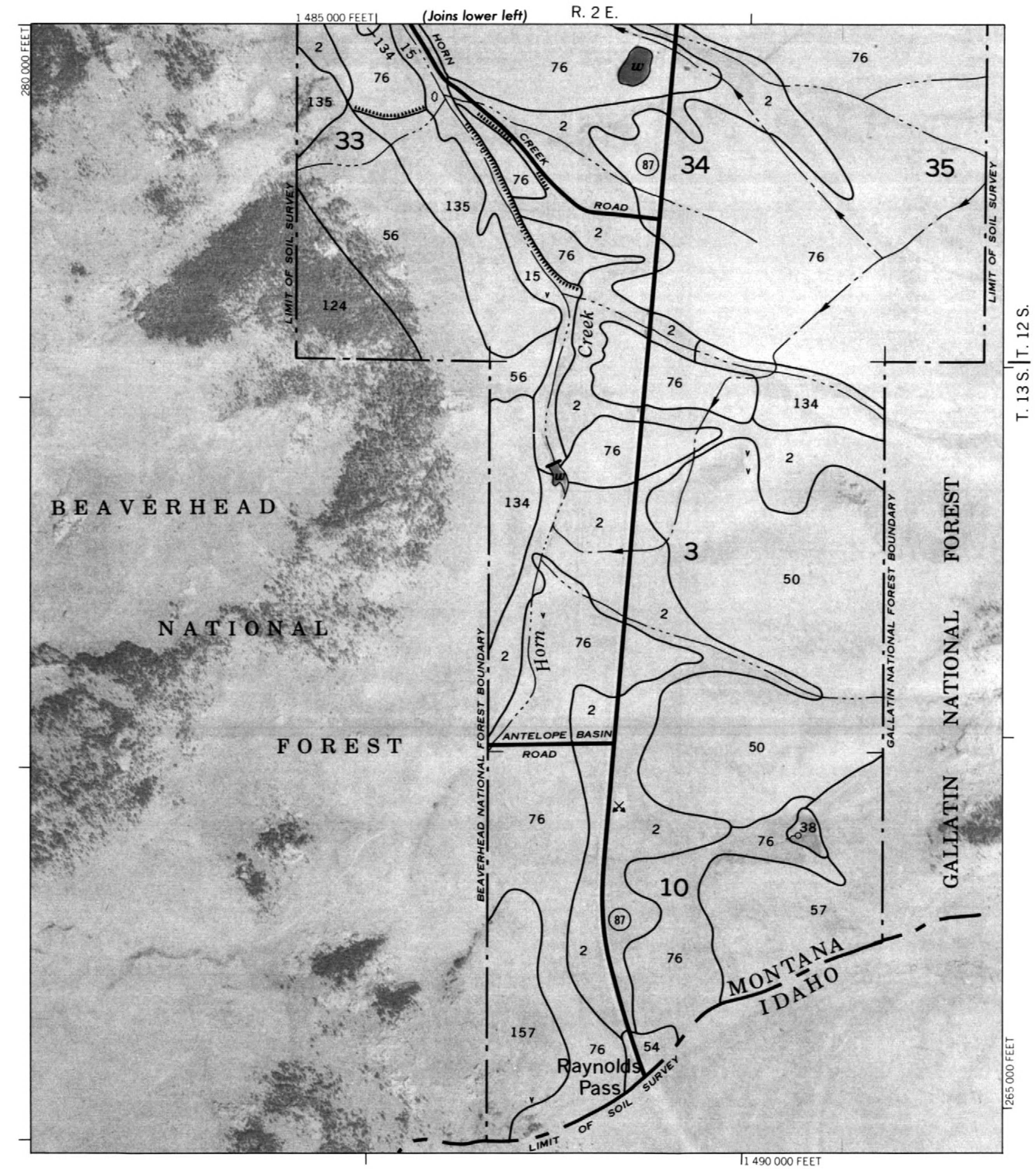
1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

SOIL SURVEY OF MADISON COUNTY AREA, MONTANA — SHEET NUMBER 168

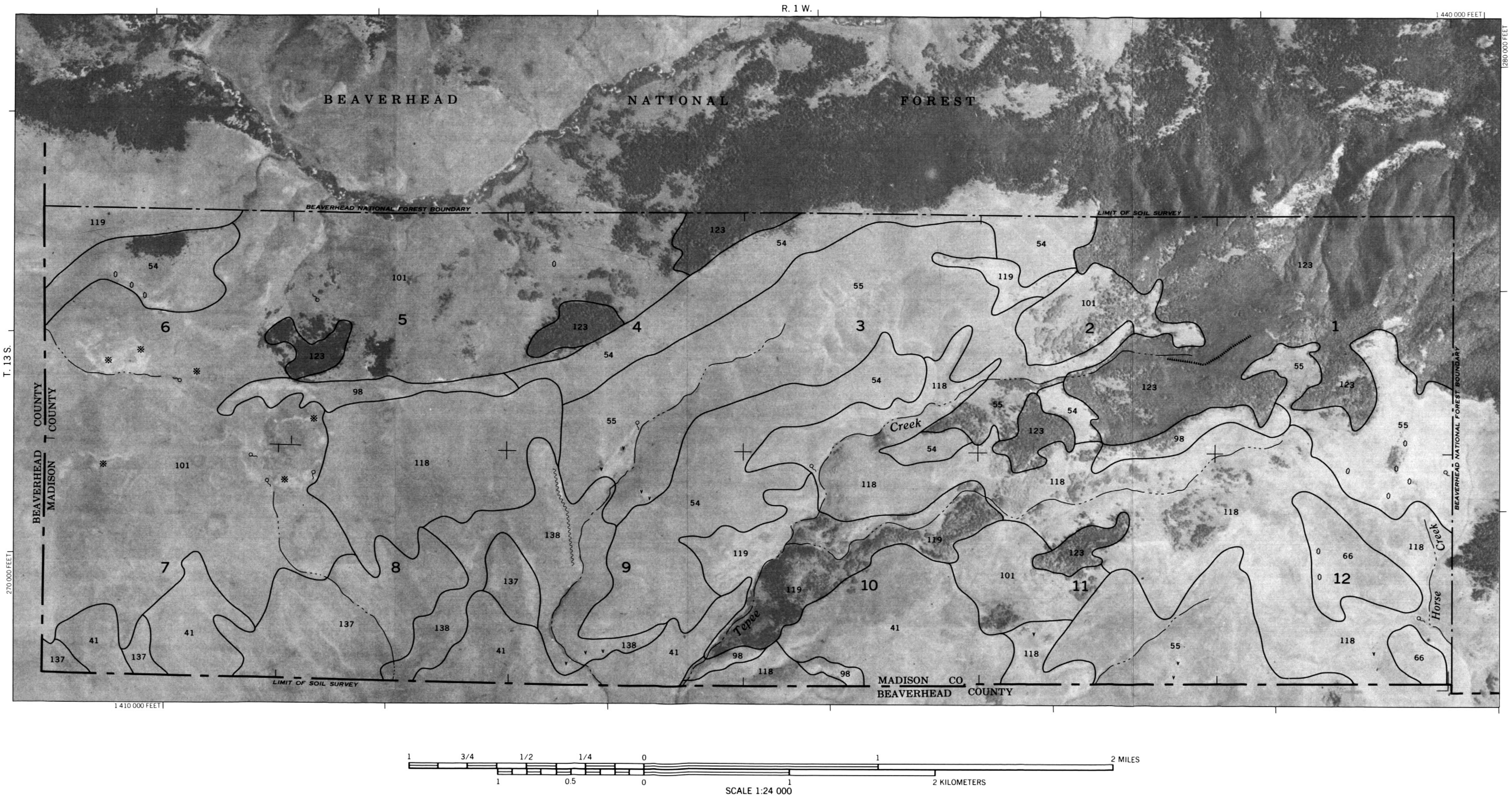




1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000


169
N
R. 1 W.
1 440 000 FEET
280 000 FEET
T. 13 S.
270 000 FEET
1 410 000 FEET
BEAVERHEAD NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST BOUNDARY
LIMIT OF SOIL SURVEY
BEAVERHEAD COUNTY
MADISON COUNTY
MADISON CO
BEAVERHEAD COUNTY
Creek
Tepee
Horse Creek
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000